FOUNDRY TRADE JOURNAL

EST. 1902

VOL. 105
No. 2190
Registered at the G.P.O. as a Newspaper

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

OCTOBER 2, 1958
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FOUNDRY TRADE JOURNAL

Vol 105. October 2, 1958 No. 2190

Established 1902

Incorporating

IRON & STEEL TRADES JOURNAL

Single copy 1s.; *by post* 1s. 4d.

Annual subscription: home 52s., *abroad* 60s. (*prepaid*)

Editor:
V. C. FAULKNER, F.R.S.A., HON.M.I.B.F.

Assistant Editor: A. R. PARKES, M.I.B.F.

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Advertising Manager: F. BARRINGTON HOOPER, B.A.

Production Manager: R. J. LOVELL

Publisher: H. J. DWYER

Circulation Manager: E. T. GRIFFITHS

District Representatives: G. P. ELLIOTT (Northern Area); T. H. SMITH (Scotland)

The FOUNDRY TRADE JOURNAL is the official organ of the British Steel Founders' Association; Association of Bronze & Brass Founders; Light Metal Founders Association; Foundry Trades' Equipment & Supplies Association; and the National Society of Master Patternmakers.

AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Every Thursday by Industrial Newspapers, Limited

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ADELPHI, LONDON, W.C.2

Telephone: Trafalgar 6171 (*Private Branch Exchange*)
Telegraph Address: "Zacatecas, Rand, London."

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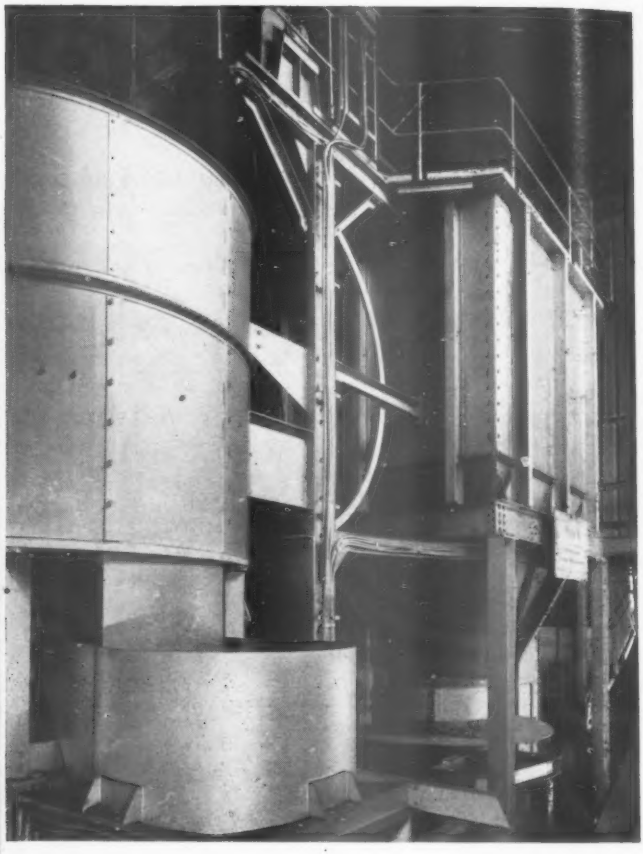

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FOUNDRY
TRADE JOURNAL

Vol. 105 OCTOBER 2, 1958 No. 2190

Importance of Technical Education

Mr. Geoffrey Lloyd, Minister of Education, at a meeting at which he launched a Government pamphlet, "Britain's Future and Technical Education" which is being widely circulated, said that the production during the next decade of a large high-grade body of technologists is of vital importance to the welfare of the nation, just in the same way that a navy of preponderating strength was of inestimable value to the Victorians and Edwardians. He pointed out that in recent years, 20 per cent. of our exports were in new lines of business and these needed the support of a well-trained cadre of technical executives.

His Ministry, he said, had spent a high proportion of the £100 million it had been voted in 1956, and the great progress registered since that time is well set out in the booklet. He appreciated to the full the co-operation he had received from industry, but still wanted increased support. This autumn, he said, some half-million youngsters were entering the country's technical colleges and in a few years time, they would be entering industry. During this period, managements should, and must, take an interest in the work of the technical colleges, so that they could assure themselves that their approach to the new conditions were of the right type. No better method exists than by visits to works by the staff and pupils of schools and colleges and close contact with the education centres by management.

The Press seemed eager to have information as to the part-time release of works' staff to conduct courses at the technical schools. So far as the foundry industry is concerned, this is done to quite a large extent for courses held at the National Foundry College and for the special weekend seminars held for supervisors. What the Minister had in mind, however, was the extension of this effort to serve the local technical colleges. The advantage of this system is that the works' official learns first-hand and personally which of the students are likely to make the most progress in his particular works. It is not easy to release busy works' executives for this purpose, but intelligently approached, the scheme can be a good insurance for the future prosperity of an industrial concern. The booklet has a number of other worthwhile suggestions for increased and closer co-operation between industry and education, including the employment in a consultancy capacity of members of the staffs of the colleges.

Incorporated Plant Engineers

An important stage in the progress of the Incorporated Plant Engineers is marked by the recent transfer of the headquarters of the Institution from the Midlands to London, at 2, Grosvenor Gardens, S.W.1. The Institution had its origins in the second world war when the engineers in charge of the large American excavators imported for working open-cast coal met together for the exchange of information and mutual help. The meetings proved so beneficial that the engineers concerned decided to continue them through the medium of an institution. This was formed in 1946, and within a year there were branches holding monthly meetings at London, Birmingham, Manchester, Leeds, Newcastle, Glasgow, and Bristol. The following year saw a further six branches established, and by 1954 there were 18 branches in the United Kingdom and one (Bombay) overseas. Membership, which at the end of 1946 was 120, is now nearly 4,000, of whom more than 500 are overseas, spread throughout most countries of the world.

Education and training have been a main concern of the Institution from its inception and the education committee (in February, 1947) was one of the first to be appointed by the Council. This committee took a major part in the establishment of the City and Guilds of London Institute's Certificate in Plant Engineering (Course 187). Its other main activity has been the organization of refresher courses for senior works and plant engineers which are held each winter at university level in various industrial centres. The Institution emphasizes that the plant engineer's need is not only for technical attainments, but for progressive thought, breadth of vision, adaptability and cost-consciousness.

Magnesia from Sea-water

Situated on a 24-acre coastal site at Hartlepool, Co. Durham, a £5,000,000 works was inaugurated by the Steetley Company, Limited, in 1937. A pilot plant was first installed in order to produce refractory magnesia by reacting burnt dolomite with treated sea-water. At that time it was considered by many to be unnecessary to go to such lengths to obtain a material which could be won by simple mining operations in Austria. Britain has no indigenous deposits of magnesite, however, and the strategic importance of the new plant was soon realized as war became imminent.

A full-scale plant—the world's first sea-water refractory magnesia unit—was laid down in 1938, and this was producing at the annual rate of 4,000 tons by the following year. Development thereafter was rapid, as large quantities of magnesia were required not only for the manufacture of high-temperature refractories but also for the production of magnesium metal for incendiary bombs and the various magnesium-alloys used in the aircraft and other industries. This year, production rate has reached 150,000 tons per annum, the bulk of which will be supplied to the refractories industry, including Steetley's own brickmaking plants.

The economics of the process are such that the company is able to market magnesia at 70 per cent. of the import price and to effect an annual saving in foreign exchange of £4,000,000. Moreover, independence from Austrian sources has freed the British brickmakers from the previously imposed export restrictions, with the result that magnesite and chrome-magnesite bricks to the value of £1,000,000 a year are now being exported from this country.

MOROCCAN CANNON

Visiting the batteries at Mogador in Morocco, a JOURNAL *correspondent noticed some fine old cannons, most of them being of bronze; some bearing the dates of* 1595, 1614 *and* 1777. *On making enquiries as to their origin, he was given permission to inspect the archives and found that they were made, respectively, in Lisbon, Seville and Barcelona. Unfortunately, the names of the actual foundries were not on record. The accompanying photographs show the state of preservation of these castings.*

International Foundry Technology

Synopses and Extracts from Papers presented at the Belgian Congress

In total, 37 papers were presented at the Foundry Congress organized by the International Committee of Foundry Technical Associations and held this year (September 28 to October 4) in Brussels and Liège. From these, a number of extracts have been culled, or summaries made, and these are reproduced in what follows. With the Congress papers which are to be printed *in extenso* in this JOURNAL, the whole forms a comprehensive survey of present-day problems of foundry technology, and the methods put forward for their solution in various countries.

Improvement of Cast Iron and Cast Steel by Copper Additions

*By P. Van Bleyenberghe and R. Coussement**

* The Authors are technologists at the Central Works (Jadotville, Belgian Congo) of the Union Minière du Haut-Katanga, and the paper was presented to the Congress by Mr. J. Delbeke, who is attached to the head office of the firm in Belgium.

The addition of copper to certain castings in grey iron or steel has brought about an improvement, and made it possible to solve some special problems arising from their application. The authors quote four practical examples of this use of copper by evaluating results obtained on a commercial scale, *viz.:*

(1) *Cast Iron with* 3 *per cent. Copper.* This iron permits the production of various castings capable of giving both a satisfactory elastic deformation, and a good wear-resistance, within the tolerance of the SNCFB (Belgian Railways) specifications.

(2) *Chilled Grey Iron with* 1.5 *per cent. Copper.* The reduction of silicon content, and the introduction of 1.5 per cent. copper, result in a better structure of chilled grey irons and particularly give: (*a*) an improved wear-resistance of the chilled layer, and (*b*) a better uniformity of product.

(3) *Hard Steel with* 2 *per cent. Copper.* The addition of 2 per cent. copper to hard steels to be used in the production of chill-cast grinding-balls, makes it possible to obtain an austenitic structure. A "Norman" test has shown an improved wear-resistance and, in practice, a 12 per cent. saving in the use of grinding-balls can be achieved.

(4) *Castability of Steels with* 1.5 *per cent. Copper.* The running problem for a number of ordinary carbon-steel castings having thin sections has been solved by adding from 1.0 to 1.5 per cent. Cu. It has been possible to prove by commercial applications that this addition has the same practical effect as an increase of the pouring temperature of from 50 to 70 deg. C.

Production and Uses of a Cobalt Alloy

*By P. Van Bleyenberghe**

* Also presented by Mr. J. Delbeke.

After defining the aims for certain products of the foundry of the Union Minière du Haut-Katanga at Jadotville, the author shows how a problem of high mechanical resistance at elevated temperatures has been solved by producing a commercial cobalt/chromium/iron alloy with 50 per cent. Co in two different grades. He investigates in detail (for each grade) the working methods, some characteristics, and the metallographic structure. A few practical examples of application of the alloy in the field of thermal metallurgy and in the "hydro"-metallurgy of non-ferrous metals indicate the technical and commercial scope.

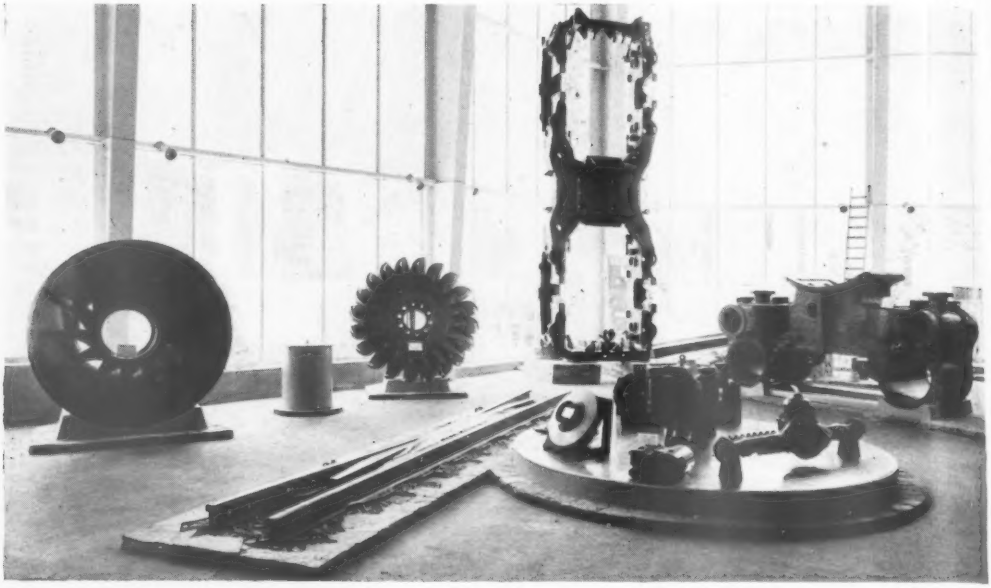
Effect of Various Deoxidizers on Cast Steel

*By C. E. Sims and C. W. Briggs**

* Mr. C. E. Sims is technical director, Battelle Memorial Institute, Columbus, Ohio, and Mr. C. W. Briggs is technical and research director, Steel Founders' Society of America.

Deoxidation of steel for casting is primarily carried out to prevent porosity but the mechanics of deoxidation are often poorly understood. Carbon and hydrogen are mild deoxidizers that form gaseous products and the purpose of stronger deoxidizers is to prevent these elements from reacting during solidification. Strong deoxidizers are chemically-active elements and may form stable sulphides, nitrides and carbides, as well as stable oxides. The side reactions of deoxidizers effect the type and distribution of non-metallic inclusions in the steel, particularly sulphides, and have consequent effect on the mechanical properties. These side effects are part of the price founders pay for the protection afforded by deoxidation procedures.

In the Paper, the characteristics of the various



This and other illustrations of the Belgian Metallurgical Pavilion are reproduced by courtesy of Fabrimetal, and Mond Nickel Company, Limited.

FIG. 1.—*Spectacular arrangement of large castings in the Metallurgical Pavilion at the Brussels Exhibition. Locomotive frame and cylinder castings, a Pelton wheel, a turbine rotor and a cast-steel rail-crossing are the principal exhibits.*

deoxidizers are described. Silicon and manganese are the great common deoxidizers with manganese the most-nearly-indispensable one. Aluminium is the most useful strong deoxidizer. Titanium, zirconium, and mischmetal are strong deoxidizers useful for special purposes. Selenium is not a deoxidizer but is sometimes useful in improving ductility. The alkali and alkali-earth metals are too volatile and too insoluble in steel to be useful deoxidizers. Complex deoxidizers can be useful, but elements added in combination have no action different from that when added separately.

Effect of Various Factors on the Mechanical Properties of Magnesium-alloy Castings

*By J. W. Meier**

* Principal metallurgist (non-ferrous metals), physical metallurgy division, Mines Branch: Department of Mines and Technical Surveys Ottawa.

The designer and the producer of mechanically-stressed equipment only considers the use of castings for components exposed to severe service conditions if detailed information on casting properties is available. Unfortunately, there still exist some misconceptions in the interpretation of test results obtained on various kinds of cast test-bars—separately-cast, cast-on, or cut out of castings—and in some cases lack of understanding of the numerous foundry and testing variables, which affect either the mechanical properties of the casting or the results of the tests.

These variables are related to the melt quality (composition, impurities, melting procedure, holding time); to casting conditions (casting design, gating, section size, pouring temperature and technique); to heat-treatment (if applicable), and to testing methods, design, preparation, size and shape of test-bars, loading speed, gauge length, etc.

Some of these factors were investigated on various magnesium sand-casting alloys in the as-cast, aged, and fully-heat-treated conditions. Results of this investigation are presented and discussed.

In the conclusions it is suggested that full advantage be taken of the direct relationship between the mechanical properties of casting sections and their grain size and structure. Greater use of metallographic inspection of critical sections in castings is proposed, in order to reduce the number of mechanical tests needed in final acceptance tests.

Review of Watercooling Systems for Cupolas

By C. Longaretti and C. Ponsotti**

* The Authors are technologists, the former being attached to U.I.S.A.A., of Milan, and the latter from Legnano, Italy.

The widespread use of water-cooled cupolas has induced the authors to review the development of

cooling systems, and to make an investigation on the cupolas of this type in use in Italian foundries. According to the latest information obtainable, 61 American foundries possess cupolas of this type. The report gives a survey of the published literature on this subject and the conclusions to be drawn from these sources. It also mentions the practical results obtained by modifying the design and the working methods of water-cooled cupolas.

The cooling systems as such are examined irrespective of whether they are used on hot- or cold-blast cupolas, or whether the linings are acid or basic. Consideration of metallurgical problems is deliberately kept within very narrow limits because the authors realize that the purpose of their work had essentially been to examine the various systems so far in practical use, and to give factual statements about the characteristics of the various systems.

Adapting Theory to Practice in the Manufacture of Light-metal Castings

*By Merton C. Flemings and Howard F. Taylor**

*Of the Authors, Mr. Flemings, Jr., is assistant professor, and Mr. Taylor professor, of metallurgy of the Massachusetts Institute of Technology.

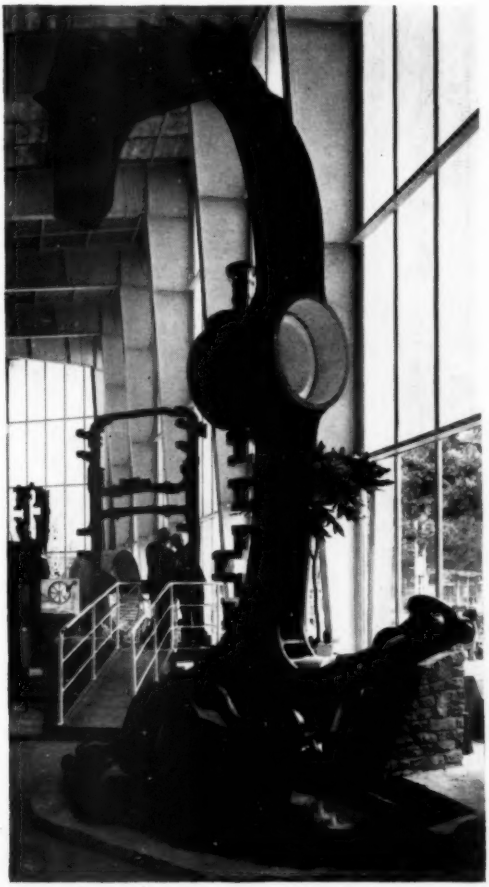
In 1951, a basic research programme was undertaken at Massachusetts Institute of Technology to study the effect of solidification variables on the mechanical properties of aluminium casting alloys. After seven years' work, essential results of the research have been that: (1) factors preventing full development of mechanical properties in cast-aluminium alloys are identified; (2) laboratory techniques have been developed to control these factors, and to produce castings with mechanical properties approaching those of forgings, and (3) these laboratory techniques have been adapted directly to commercial practice.

Most of the fundamental research was done on a typical aluminium alloy (alloy 195-A1/4.5 per cent. Cu). Studies of the effect of thermal variables on solidification structure, and of the effect of structure on properties, were conducted. It was concluded that the primary factors tending to weaken and embrittle commercial alloys were (1) microporosity and (2) brittle intermetallic compounds. Data developed in this phase of the research programme were translated to shop techniques by the production of more than 100 intricate castings with tensile strengths 50 to 100 per cent. higher than Government specifications and with elongations as much as 700 per cent. greater; of even more significance, these properties were reproduced and can be guaranteed *in the casting itself*, and have been obtained in castings weighing from one ounce to over 6 cwt.

The research and production results are equally adaptable to light alloys other than specification 195; development work conducted on test specimens, and through extensive production of prototype castings, has shown the techniques to result in substantial improvements in soundness and mechanical properties of 356 alloy (A1/7 per cent. Si/0.3 per cent. Mg); AZ91C alloy (Mg/8.7 per cent. A1/0.7 per cent. Zn/0.15 per cent. Mn), and AZ92A (Mg/9 per cent. A1/2 per cent. Zn/0.15 per cent. Mn). For example, using the careful foundry procedures described, intricate castings of 356 alloy are being produced commercially with *minimum* mechanical properties *in the casting* of 17 tons per sq. in. tensile strength, 12.5 tons per sq. in. yield strength and 5 per cent. elongation. Present specifications used in the United States for purchase of castings anticipate *average* mechanical properties in 356 alloy castings as low as 10 tons per sq. in. tensile strength, 6.7 tons per sq. in. yield strength, and 0.75 per cent. elongation.

Some corollary fundamental researches not directly related to casting production techniques are also described in the paper for the interest of the more-theoretical-minded engineer.

FIG. 2.—*Large steel castings—including rudder bracket, anchor and chain—also shown at the Belgian Exhibition.*



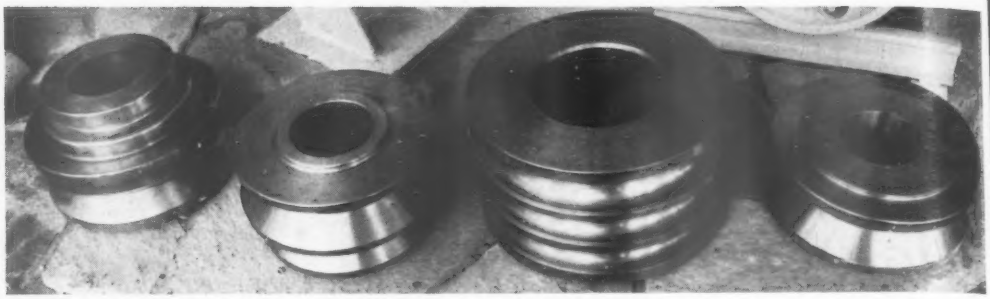


FIG. 3.—*Straightening rolls for angle-iron and tube, both in slow-cooled iron and in quenched nickel/chrome cast iron, the third from the left is made in s.-g. iron.* (*Griffin.*)

Cold- and Hot-strength of Moulding Sands, Core-sands and Chaplets

*By R. Collette, F. Gaty and R. Namur**

* The Authors are, respectively, technologist, foundry division, S. A. Cockerill-Ougrée; senior lecturer, University of Liège, and metallurgical engineer, Belgian State Armament Works, Herstal.

A number of experimental physical tests at various temperatures ranging from zero to 1,200 deg. C. have been carried out with foundry sands supplied by different works (sands for cast iron and for steel, core sands, cement sands, CO_2-sands, etc.). Their compression strength has been measured from ordinary temperatures up to elevated temperatures —at which a reduction of strength was observed. For these experiments a particular and ingenious method was developed which permitted the observation of the deformation of sands and chaplets, and their resistance against buckling, and shear strength, were recorded. Further investigations were carried out in order to measure the temperatures and pressures developed in the moulds, during pouring. The rôle played by blackings used in the foundries is described, and these will form the subject of future investigations.

Effect of Ladle Additions on Cast Iron—Degree of Normality and Relative Hardness as Criteria of Quality

*By W. Patterson**

* Director of research, Foundry Institute, University of Technology, Aachen.

Concepts of "degree of normality" and "relative hardness" are put forward for the evaluation of the quality of grey cast-iron. The "degree of normality" (RG) of cast bars of 30-mm. (about 1.2 in.) cast diameter is given by:

$$RG = \frac{\sigma B}{102 - 82{\cdot}5\ Sc}.\ 100 \text{ per cent.} \equiv \frac{157\ uts}{102 - 82{\cdot}5\ Sc}$$

per cent.

Where σB = tensile strength in kg. per sq. mm.; Sc = degree, and uts = ultimate tensile strength in tons per sq. in.

The "relative hardness" (RH), independent of wall thickness, is calculated from:

$$RH = \frac{HB}{100 + 4.3\ \sigma B} = \frac{HB}{100 + 6.8\ uts}$$

Where HB = Brinell hardness; σB = tensile strength in kg. per sq. mm., and uts = ultimate tensile strength, in tons per sq. in.

Cast irons with "degrees of normality" above 100 per cent. and "relative hardness" values below unity are to be regarded as of high quality. The ratio RG : RH is proposed experimentally as an index of quality but this idea needs further testing.

It is concluded that high degrees of normality and low relative hardness are regarded as indicative of high quality in cast iron, only in those types of iron which contain mainly "A" graphite (according to the American classification)—a graphite form found in heavily nucleated melts. Nuclei foreign to the melt are destroyed by superheating; their reformation can follow at lower temperatures, only if sufficient time is available, but the time required can be reduced by "inoculating" ladle additions.

Fineness of graphite in a metallographic specimen is no indication of high quality; on the contrary "D" and "E" types of graphite are markedly unfavourable. The effort to achieve finer formations of graphite by even more intense superheating of the melt must be regarded as a tragic error in the history of the development of grey cast iron. The types of iron so produced show a low degree of normality and high relative hardness.

The following conclusions are drawn on melting technique: (1) Charges right in "A"-type graphite should not deliberately be heated above about 1,400 deg. C. (2) Charges containing few nuclei should be strongly superheated to even out the different nucleating effects of the individual types of iron present. The melt must then be given sufficient time at lower temperature for the formation of new nuclei. More effective is a subsequent treatment in the ladle with an inoculating addition at not too high a temperature (about 1,400 deg. C. max.).

Problems Presented to Professional Education by the Modern Operation of Industrial Enterprises—Practical Solutions in the French Foundry Industry

*By D. Waeles**

* The Author is past-president of the International Committee of Foundry Technical Associations, president of the joint committee for professional education set up by the French Association of Metallurgical and Mining Industries and French Foundries.

As the studies made so far on professional development concern almost exclusively technical questions and matters relating to production personnel in the works, the author points out that the activities of a modern undertaking can be divided into eight sections, and stresses the importance of placing into each of them men who have received a special preliminary training.

The author then proceeds to mention a number of prejudices, deep-rooted in the foundry industry, some of which, he admits, may certainly be considered to have some actual basis in truth. The particular steps taken by the French foundry industry are then examined individually, and the author then concludes by placing particular emphasis upon the importance of the difficult problem which faces firms who wish to offer their personnel definite prospects of a continuous improvement of their status within the firm.

Gases in Cast Iron

*By B. Marincek and H. Feichtinger**

* Joint Paper from the department of metallurgy, University of Technology, Zurich, and the gas/metallurgical laboratory of George Fischer A.G. Schaffhausen.

Using various cast-iron samples, the possibility of applying a method of gas-analysis has been studied, by means of which the total volume of gas, as well as the composition, and that of the fractions obtained at different temperatures, can be investigated. At the same time the speed of gas evolution is recorded. It is shown that this method can be favourably considered for the gas analysis of cast iron.

Because of the high affinity of cast iron for gases, it is essential, in order to obtain comparable gas-analysis figures for cast iron, that the sample should be obtained in a satisfactory manner; that the analysis should proceed at the earliest possible moment after sampling; that the gas apparatus should work with a low "blank," and that the degassing of the testpiece should be continued up to about 2,000 deg. C.

After describing the gas-analysis apparatus and the method of taking the samples, analyses results for various cast-iron samples are reported and commented upon as an illustration of the usefulness of the method.

Thermal Behaviour of Aluminium/Magnesium Casting Alloys

*By Van Ewijk, D.Sc.**

* Chief metallurgist, "Industrie" Vassen, Holland.

This Paper is the third of a series of publications on the properties of aluminium/magnesium casting alloys containing from 5 to 12 per cent. Mg. The first paper dealt with the heat-treatment and described, both for ordinary-quality and high-grade aluminium, the mechanical properties obtained and also showed the effects on these alloys when homogenizing at various temperatures at short and long duration. Photomicrographs illustrated the results. The second paper described the ageing phenomena of these alloys and the influence which cold-working after homogenizing exerts upon ageing. The accompanying changes in the microstructure were studied. The tests recorded in the first and second paper were carried out at room temperature (with the exception of a tentative approach towards impact tests at sub-zero temperatures).

In this present Paper, the behaviour of the same alloy is investigated both before and after ageing and at temperatures ranging from −100 to +100 deg. C. (and in some cases to +200 deg. C.). For comparison, parallel tests were carried out with seven different commonly-used aluminium casting alloys. The results of these investigations show that the temperature behaviour of Al/Mg alloys containing up to 9 per cent. Mg is fairly satisfactory and—within the temperature- and time-range studied—in line with that of the alloys used for comparison.

The relative loss of mechanical properties of these Al/Mg alloys is, however, more severe: as shown in the tables and graphs, they start with superior properties and yet still remain comparable with the other alloys despite their loss of properties at the end of the test series. Aluminium alloys

FIG. 4.—*S.-g. crankshaft for a four-cylinder engine. (Cockerill-Ougrée, S.A.)*

FIG. 5.—*Group of three cast rolls, that in the foreground being for a merchant bar-bill, in s.-g. iron. (Griffin.)*

containing more than 9 per cent. Mg proved, however, to be unsuitable for application where thermal stability at even modestly elevated temperatures is of importance. The changes in structure are explained by photomicrographs.

Properties and Testing of Materials Used in the CO_2 Process

*By D. A. Taylor**

* The Author is attached to the British Cast Iron Research Association.

Factors which influence the properties of moulds and cores produced by the carbon-dioxide process have been studied at both room and high temperature. Methods of testing are described in the Paper and from the tests the effects of silica : soda ratio, silicate viscosity, time, temperature of gassing, and amount of carbon dioxide required have been found. The use of dried powdered silicate with damp sand, as an alternative to the more usual combination of dry sand and silicate solution, has also been examined.

It is shown that economies can be obtained by using carbon dioxide diluted with air in place of the pure gas. Under some conditions, it is possible to use a proportion of reclaimed sand in place of new sand. The effects of the presence of used sand, arising from previous use of the process, on the properties of clay-bonded sand is also included.

Tests of CO_2-bonded sands at high temperature show that the rate of evolution of gas is low, even with the presence of organic materials such as pitch, coal-dust, wood-flour and sugar. The presence of sodium silicate in a silica sand reduces the temperature at which quartz converts to cristobalite, and greatly increases the rate of conversion. This transformation is almost completed in a few minutes at 1,300 deg. C. but the rate of change can be reduced effectively by the addition of small proportions of finely-divided alumina.

The problem of breakdown of cores after casting is commented upon, and it is shown that with wood-flour and coal-dust the greater ease of breakdown is mainly due to a reduction in strength at all temperatures. Certain inorganic materials can, however, be used to facilitate breakdown to a limited extent, without reducing the strength at room temperature.

Metallurgical Technique and Applications of Alloy-iron Castings for Diesel-engine Parts

By B. V. Mahabale, B.Sc.

The Author, who is chief metallurgist and works manager, Mysore Kirkloskar Limited, of Harihar, India, in this paper briefly dwells on the role of the technique of metallurgy in manufacturing the castings for diesel engines. He gives an idea of the melting methods, moulding technique, laboratory tests, quality control, etc., employed—taking into consideration the science of foundry practice and production metallurgy.

Factors arising in the manufacture of castings on the quality and quantity basis are commented upon, and tests employed to control metal properties are described. The paper reviews also the effect of some of the important methods specially adopted while melting the high-duty cast-iron suitable for diesel-engine castings.

Vacuum Practice in the Foundry

*By Z. Eminger and Z. Kletecka**

* W.I. Lenin Works (formerly Skoda Works), Pilsen, Czechoslovakia.

Evaluating the results obtained, it is possible to state that vacuum treatment of aluminium/silicon alloys provides the following advantages: (*a*) Reduction of the hydrogen content results in more consistent castings; (*b*) reduction of non-metallic impurities; (*c*) refinement of structure, and (*d*) improvement of mechanical properties. The process described uses normal metallurgical operations and materials with standard foundry practice. The vacuum employed, of 2 to 4 mm. Hg (which is feasible in practice) involves equipment that is already technically adequate.

It is believed that the introduction of this process into routine practice—provided that the vacuum technique is applied to the whole production capacity of the foundry—would achieve a considerable improvement of casting quality and a reduction in casting scrap. The method would have the additional advantage of reducing the effect of varying material quality, and the irregularities and fluctuations of the technical process would be reduced to a minimum.

This work, which is valid for aluminium/silicon alloys only, is certainly not a sufficient basis for a general introduction of the proposed method. Before this is possible, further conscientious and hard work will be required. The Paper is only intended to show how promising this process is, and at the same time to encourage the endeavour to apply methods previously overlooked, which make the use of the basic laws of physics, for the improvement of the casting quality.

Man and Labour in the Foundry

*By Dr. H. Scholz**

* The Author is attached to the *Max Planck-Institut für Arbeitsphysiologie*, of Dortmund, Germany.

For the past two years, investigations have been carried out at the "Max Planck-Institute of the Physiology of Work," Dortmund, to determine the physiological "load" on a worker in old-fashioned, and modern, foundries and how the environment and equipment affect this load. An attempt was also made to determine the best means of technically adapting work and environment to the men doing the work. The working conditions and body load were determined for 200 men selected at random from 13 foundries. So far, it has been shown that in about one half of the men the physiological "loadings" have exceeded permissible values both in energy expenditure and circulatory strain, but in highly mechanized foundries, relatively fewer men were physiologically "overloaded." The main causes of this overload in foundries are: Excess energy-expenditure resulting from inadequate transport facilities; muscular fatigue arising from use of machinery ill-suited to the operator; heat, and noise. Lastly, the worker himself contributes by not fully observing the specified rest periods or by commuting them under some financial agreement.

In older foundries, the heaviest work is connected with sand-preparation by hand, shovelling of sand into moulding boxes, their subsequent transport by hand to the casting area, knocking-out, hand transport in general and stacking. The installation of mechanized sand-preparation and sand feed, roller conveyors, knock-out grids and modern moulding machines brought about an appreciable reduction in the load on the worker, although the labour force remained highly "loaded." Further mechanization such as loading and unloading the conveyor and a change from mechanical to electrical servicing of hoppers provided additional relief.

Measures Proposed

As it was possible to show at which operation the optimum working conditions were not being achieved—bearing in mind the physiological limits of bodily "loading"—it was possible to point out where new measures should be introduced. Here, a series of examples is quoted. Each new measure to which the worker is thus introduced should have the aim not only of increasing and improving production but also of decreasing the load on the worker. The limiting factor to an increase in production must always be the endurance of the worker and not the capacity of the machine which he uses.

Correlation of Service Performance with the Metallographic Structure of Castings

*By Prof. R. A. Flinn**

* The Author is on the staff of the Metallurgical Engineering University of Michigan.

The performance of a casting depends upon five principal variables: (1) Service conditions, (2) design, (3) residual stresses, (4) soundness, and (5) metal structure. After illustrating the importance of the first four subjects, major attention in the Paper is devoted to the relation of performance to metal structure.

Examples of the correlation of performance with structure are given in the following fields: (1) General engineering properties such as mechanical properties, (2) wear and abrasion, and (3) heat- and corrosion-resistance. It is established that if other variables are kept constant, engineering performance depends uniquely upon the structure. Substantial improvement is possible by observation of the effect of nature, amount, size, shape, distribution and orientation of micro-constituents.

Growth of Grey-iron Castings Production and Some Factors Affecting It†

*By Lars Vilner**

* The Author is metallurgical engineer attached to the Foundry section, Swedish Foundrymen's Association.

† So great is the potential value of the statistical information quoted in this Paper, that it is proposed at quite an early date to reproduce substantially the whole of it in this JOURNAL. —Editor.

Statistical studies have shown that the rate of growth of the production in tons of grey-iron castings in Sweden, Germany, the USA, and Great Britain during the past decades has been clearly below the level for total industrial production, and considerably below the level for the engineering industries and other industries in which grey-iron

FIG. 6.—*Miscellaneous castings and models displayed in the Metallurgical Pavilion include a large rotor, an internal-tooth gearwheel, complicated valve plate and a flywheel.*

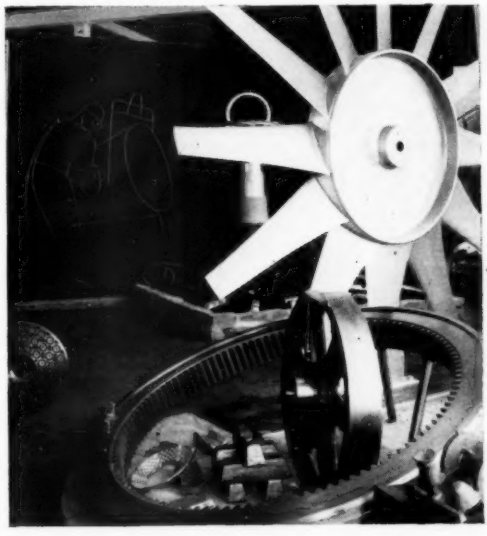


FIG. 7.—*Part of the Belgian Metallurgical Pavilion at the Brussels Exhibition showing (right) die-castings, and (left) groups of medium-size castings.*

products are used. The relation can be expressed by an equation of the type: $y = a.x^b$, where y = grey-iron castings production, a is a factor and x = industrial production. The exponent b indicates a lag which, compared with general industrial production, is 0.7-0.8 and, compared with the engineering industries, 0.4-0.6. There are indications that the tendency may have changed in the last few years and, as a result, the growth might in the future be slightly slower.

The comparatively low rate of growth is due mainly to three factors: (1) Technical improvements of grey-iron and methods of casting resulting in lighter castings and consequently lower totals tonnage. (2) Competition from other materials and methods. The keenest competition has been offered by welded and sheet-metal products, and also light-metal castings production has had some effect on grey-iron production. Plastics and forgings, on the other hand, have not had any appreciable effect. (3) Industrial production is increasing mostly in the case of products in which castings are only used to a minor extent.

Employment problems encountered during the past few years in Sweden and other countries are not due to a reduction in total production, but rather to over-capacity resulting from rapid rationalization of the production apparatus.

Behaviour of Chaplets

*By F. Kinet**

* The Author is a technologist attached to the foundry division, S.A. Metallurgique d'Espérance-Longdoz, of Liège.

After a review of Patents filed since the beginning of this century relating to the various ways of constructing chaplets, the author presents a series of data concerning the types of chaplets actually used. The next section reminds the reader of the preconceived opinions of foundrymen about the problems arising as the result of the application of chaplets. Certain early ideas regarding the conditions of the use of chaplets, the methods of their construction and their protective coatings—requirements which were difficult to satisfy—are described.

The paper also mentions some unfortunate experiences made when chaplets as previously recommended were used, and several technological experiments which are next described demonstrate the particular care required when placing a chaplet in a mould. Finally, microphotographs are used to illustrate the behaviour of chaplets and their influence on the surrounding metal.

Flow of Aluminium Sand Moulds

*By Prof. Dr. G. Ohira**

* Department of Metallurgy, Tohoku University, Sendai, Japan.

The flow of aluminium in green-sand moulds was investigated by applying electrical techniques, and the temperature of the flowing metal was also measured by employing the electromagnetic oscillograph.

Both castings lying mainly in the horizontal plane, and those in a vertical plane, were investigated, and the flow patterns obtained were described in each case.

When metal first enters a mould, there is much agitation and splashing and the front of the running stream tumbles over itself as it proceeds. Soon, however, agitation and splashing tend to die out and a constant flow is established. Yet, with small castings the metal fills up the mould before the state of constant-flow is reached. When metal flows into a narrow channel, it cools quickly to the freezing temperature at its edges, but still continues running though the metal stream is accompanied by solidification on the mould walls, and the front of the running metal, as it cools, is outstripped by hotter metal from behind.

It is a notable fact that the momentum effect is remarkable when considering the flow of metal, particularly when the duct from the runner to the mould cavity is not sufficiently enlarged. The location and orientation of the ingates greatly affect the rate at which different parts of the casting are filled with metal. If the duct is enlarged considerably from runner to mould cavity, the momentum effect is depressed owing to the decreasing velocity of the running metal, and a greater uniformity of flow into the cavity is obtained.

Properties of Copper-based Alloy Castings

By F. Hudson, F.I.M., D. R. Wood, M.A., A.I.M.,* and J. F. Gregg, B.Sc.**

* All the Authors are associated with the Mond Nickel Company, Limited, London.

Very few data are available on the properties of castings in copper-base alloys and such information is urgently needed by design engineers, state the Authors. After reviewing relevant published literature, they describe research conducted on experimental step- and wedge-bar castings in order to determine the effects of section-thickness on the mechanical properties of 88/10/2, 86/7/5/2 and 85/5/5/5 gunmetals.

The results of this work demonstrate that composition has an important bearing upon the sensitivity of these types of copper-base alloys to variation in casting section, and that in leaded gunmetals the sensitivity is markedly reduced by small additions of nickel.

Exothermic Feeding Compounds in the Production of Steel Castings

*By D. H. Snelson, B.Sc.**

* Metallurgist, Glanmorfa, Limited, Llanelly.

The feeding characteristics of heads lined with a mouldable exothermic compound have been investigated and the principles for the design of the most efficient and economic head have been discussed.

By using a method of classification of castings based on published data of the solidification time, relationships between minimum head-diameter and section-size have been established for castings of simple section.

The effects of pouring temperature and running distance are commented upon with regard to the application of the relationships, established for relatively small castings, and extended to much larger castings of the same basic section.

Current Tendencies of Foundry Research

*By G. Blanc**

* Director of research, *Centre Technique des Industries de la Fonderie*, Paris.

Much research work is now carried out in the foundry industries and the author has endeavoured to summarize it and at the same time analyse the various trends taken. The classic distinction between technological and scientific research is not very satisfactory in this particular field because there are many investigations which, at one and the same time, show the characteristics of both. One can readily distinguish problems which are posed by the everyday course of production from those which originate as a spontaneous idea of an investigator, but these two paths converge. Equally, investigations may be classified according to materials used in production, although the general tendency is to work under conditions approximating as closely as possible to those in practice, and to apply precise methods of measurement to all tests made in these conditions and—as some scatter is inevitable in this method—to later submit the results obtained to statistical analysis.

The author chiefly examines investigations carried out in the following fields: raw materials, melting methods, treatment of molten alloys, sand studies, flow of metal, moulding technique, the "struggle" against foundry anomalies, physical characteristics of moulds and the structure of foundry alloys.

As a result of Mr. Blanc's analysis of the field of study, it would appear that collaboration between the foundry research institutes, industrial organizations, scientific bodies and research institutes of associated industries should be very fruitful, and it is desirable that this collaboration should equally be extended to the international sphere.

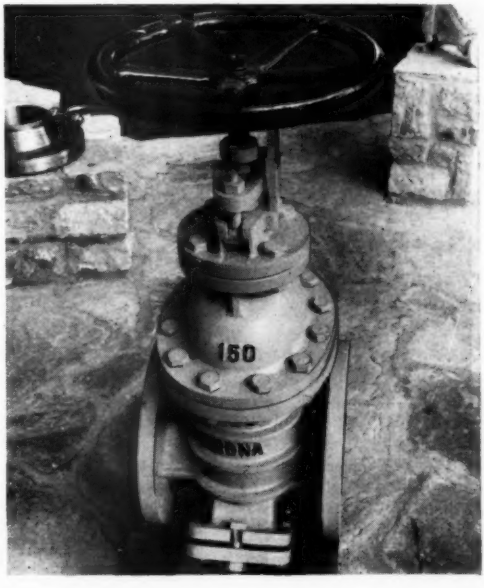
Dust-extraction Installations on Cupolas

*By R. Goenaga**

* General manager, Etablissements Ventil, at Lyons, France.

Like all dust-extraction problems, that of the cupola is defined by a number of characteristics: the type of dust, the proportion of dust in the gas and type of gas. The author investigates each of these and particularly the nature of the dust emitted. He recognizes the fundamental difference between dust from cold-blast cupolas—which con-

FIG. 8.—*Valve for the petroleum industry in s.-g. iron.* (*Lefevre.*)



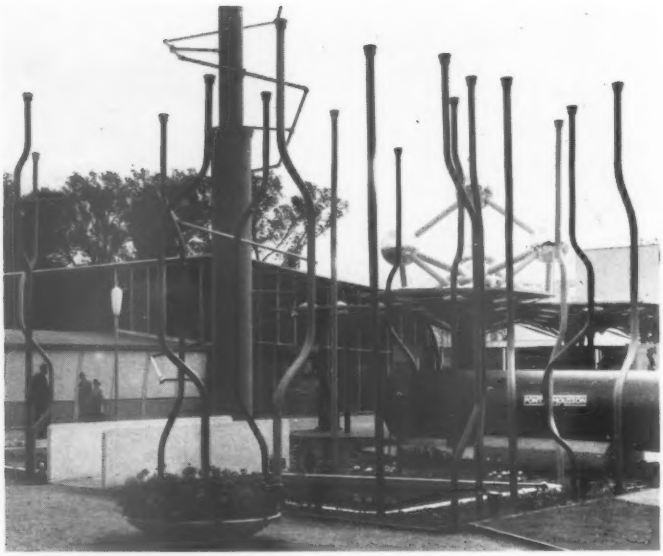


FIG. 9.—*Imposing array of bent cast-iron pipes (in addition to large straight pipes) forming part of the Pont à Mousson stand, where also intriguing displays of s.-g. iron are included.*

sists of coarse particles—and dust emitted from hot-blast cupolas—which carries with it a considerable proportion of extremely fine particles. The presence of these cannot be disregarded as they give rise to a perceptible dust cloud in the atmosphere.

The author then examines the types of dust-extraction plant in use, and classes them into two categories:—(1) Dust-extraction plants for cold-blast cupolas which can be mounted above the stack. Their design might advantageously be inspired by new ideas arising from a study of the working of cyclones. (2) Dust-extraction plants for hot-blast cupolas. These usually involve substantial plant installations at the stack base, comprising a preliminary dust-extractor for collecting the coarse particles, and a final extractor for the removal of the very fine particles.

The author describes the dust extractors generally employed and indicates their main characteristics, basing his description of their mode of operation on an appendix which explains the principles of the mechanics of suspended matter.

Recent Advances in Magnesium Casting-alloy Technology

*By E. F. Emley, Ph.D.**

* The Author is chief metallurgist, Magnesium Elektron Limited.

The metallurgical background underlying the development of magnesium alloys containing zirconium is commented on, leading to a consideration of the possibilities of useful new casting alloys arising in the future, both for normal and elevated-temperature applications. Short-time creep and tensile data are given for a number of alloys.

After considering the founding characteristics of magnesium alloys in the light of recent work on microporosity, hot-tearing, etc., mention is made of the application to magnesium of some of the newer foundry processes, including the coring of narrow passageways, and production of thin-walled castings.

New knowledge on behaviour in corrosive environments, and on surface protection, where required, follows. Other aspects of the alloys, such as fatigue characteristics, and weldability, are briefly reviewed. Finally, the principal advantages shown by magnesium-alloy castings are enumerated, and examples are included of the many ways in which the latter are now being used.

Investigations into Non-magnetic Ni/Cu/Mn Cast Iron

By A. De Sy and J. Van Eeghem†*

The Authors are * professor of metallurgy, University of Ghent, Belgium, and † metallurgical engineer attached to the Belgian Foundry Research Centre.

The aim of a systematic study of the region of stability of austenite in Ni/Cu/Mn cast iron has been to develop a series of iron compositions having a magnetic permeability of less than 1.05 in a field of 200 Oersteds. The mechanical and physical properties of the new irons are studied in this paper; and are reported to be comparable with those of "Nomag" iron.

The tensile strength of the irons, which is rather low for flake-graphite austenitic irons, can be trebled by applying a nodularizing treatment. Such nodularization is obtained either by a treatment combining Ni/Mg and mischmetal, or by the use of mischmetal alone. High contents of residual magnesium in the irons induce precipitation of a copper-rich phase.

Austenitic irons with spheroidal graphite are much tougher than those with flake graphite but the magnetic permeability is correspondingly much higher.

Grain Size of Grey Cast Iron

*By J. S. Abcouwer**

* The Author is attached to Werkspoor, N.V., Utrecht, Holland.

The first part of the Paper comprises a theoretical confirmation of the experimental work of various authors on the grain size of eutectic and hypo-eutectic grey cast irons. A mathematical expres-

sion is given for the speed of solidification. The assumption of a relationship between this speed and the grain size of grey iron is reported to confirm all the experimental findings.

The second part of the Paper endeavours to specify the relationship between the speed of solidification and the diameter of the eutectic cells.

An appendix gives a precise solution of the problem of uni-dimensional transmission of heat through a finite wall in an infinite mould. An approximation, which applies to all metals in a sand mould, gives the relationship between the thickness of actual walls and imaginary walls, arrived at on the basis of this Paper.

Runner Sizes for Iron Castings

*By C. Trenckle**

* *Ingénieur E.C.P.*, Société Alsacienne de Constructions Mécaniques, Mülhouse, Alsace.

The present Paper (of which the above title is an abbreviation) forms part of a group of investigations which aim at replacing empirical operating techniques in the foundry by a rational preparation for the job to be done. This study has been based on established laws of heat-transfer, thermal shock and fluid flow. The paper gives only a condensed version of the actual investigation, but it contains all the tables, graphs and formulae necessary for estimating the mould-filling time and runner sizes for castings in current production of peritectic cast iron, for castings of all shapes and sizes cast in all kinds of moulding sands. General and special recommendations are given and three practical examples are commented upon.

(Thin castings, in addition to iron castings of hypoeutectic structure and castings in other metals and alloys, will be investigated later.)

Human Relationships in Industry—Sociology and Empiricism

*By M. Perry**

Productivity expert of the Federation of French Foundries.

Consideration of his subject has been divided by the Author into four main sections. In the first he examines the problem along two avenues:—(*a*) The discovery of how human beings act, as a result of an exact and systematic analysis of the man/machine relationship. The impact of rapid evolution of machine techniques leads to records of studies made by sociologists. (*b*) Review of the basic factors making up the human element, leading to a realization of the necessity for introduction of confidence and understanding in administrative and technical relations.

The second section is devoted to factors influencing the human element—technical, economic and psycho-sociological, and the third contains a critical examination of some solutions. Amongst the latter are the " be friendly " advice of Carnegie; the technique of arranging limited groups—on which is based the programme of the *Syndicat Général des Fondeurs de France* (Federation of French Founders). Finally, limited conclusions are presented as a basis for a discussion, (*a*) for supplementing the preceding ideas with a view to penetrating to the heart of the problem, and (*b*) for an individual programme of education and application.

Aluminium Casting Alloy Type Al/Zn/Si/Mg

*By Dr. Ing. W. Thury**

* The Author is attached to the *Oesterreichisches Giesserei-Institut*, Leoben, Styria, Austria.

Experiments carried out at the Austrian Foundry Institute led to the development of a type of aluminium casting alloy that has not attracted technical attention previously. Patent applications for this new alloy, which is suitable for pressure-die-castings, gravity-die-castings and thin-walled sand castings have been filed in a number of countries. The new alloy for which both technical and economic advantages are claimed has been named " Durfondal "; its specification limits are: Zn 9 to 11; Si 7 to 9; Mg 0.2 to 0.4 per cent., and balance Al and minor impurities.

The tolerance of this specification is so wide that the alloy can be produced from aluminium-alloy scrap having a high zinc-content (a type of scrap which is becoming available in increasingly large quantities) particularly as impurities have little deleterious effect. Only iron above 0.7 per cent. and higher copper contents reduce the elongation of the alloy. Separately-cast test-bars from melts modified with sodium in the usual way have given the following mechanical properties (Table 1).

TABLE 1.—*Mechanical Properties of Separately-cast Test-bars.*

—	Chill cast.	Sand cast.
Ultimate tensile strength (tons per sq. in.)	18 to 20	11 to 14
Yield point (0·2 per cent) (tons per sq. in.)	12 to 15	Not recorded
Elongation (per cent)	2 to 4	1 to 2
Fatigue strength (tons per sq. in.) ..	5·5 to 6·0	4 to 5
Brinell hardness	100 to 120	100 to 110

The notch-impact value of the chill-cast alloy is about the same as for a good cast iron or a copper-containing aluminium/silicon alloy. It is a characteristic of Durfondal that it attains a good tensile strength without heat-treatment as a result of age-hardening, depending on the rate of cooling after casting. The maximum strength is obtained in eight to ten days after casting.

Other Characteristics

The new alloy possesses excellent casting properties, comparable with those of the eutectic aluminium/silicon alloy, LM 6—flowability of the new alloy is reported to be equal to or even better, and shrinkage porosity less pronounced, than in LM 6 alloy. A further advantage mentioned is that this alloy can be melted with little risk of gas or oxide absorption. The high mechanical properties obtainable with the alloy without heat-treatment, it is stated, could previously only be achieved with heat-treatable alloys which, as a rule, possess poor casting properties. In addition " Durfondal " can be hot-rolled, hot-extruded or hot-forged.

There are, however, some disadvantages con-

International Foundry Technology

nected with his alloy. As the final strength of the casting depends on the speed of cooling after casting, thin-walled castings have a much higher strength than thick-section sand castings, but hardness is scarcely influenced by the rate of cooling. Another disadvantage is low corrosion resistance on account of the high zinc content as compared with zinc-free and copper-free aluminium alloys. The high zinc-content also makes anodizing or any such treatment impossible. Practical trials of the new alloy have been made at several works; a number of sand castings have been produced and the Doehler-Jarvis concern in the USA, has used the alloy for pressure-die-castings, in which case the optimal magnesium content has been found to be around 0.04 per cent. Mg.

Institute of Metals

Birmingham Reception

More than 600 delegates to the golden jubilee conference of the Institute of Metals were welcomed at an official reception at Birmingham University on September 22, when Lord Tedder, president of the Institute, was among the distinguished participants. Addressing the assembly, Mr. Stephen F. Burman, pro-chancellor of the University, said that although it took the whole history of modern man to progress from the invention of the wheel to the steam engine, the past 50 years had seen some very rapid developments from the early stages of the internal-combustion engine to nuclear power, During the half-century of its existence, he said, the Institute of Metals had witnessed immense developments in engineering. Speaking of Birmingham, he said that the city was traditionally prominent in metal-working and the metal-using industries. It had made significant progress in the unusual metals and preparations were now being made in the city for the first tonnage plant of beryllium. Finally he referred to the programme of expansion being undertaken by the University.

Dr. C. E. Homer, chairman of the Birmingham section of the Institute, said it was an all-important stage in the history of the organization. There were very close associations with Birmingham because it was there that the first meeting was held 50 years ago.

Autumn Lecture

The golden jubilee autumn lecture of the Institute held at Birmingham College of Technology was delivered by Mr. G. L. Bailey, C.B.E., senior vice-president of the Institute and director of the British Non-Ferrous Metals Research Association, on September 23. Mr. Bailey said that the metallurgist of the future must know enough to judge when to call in the instrument engineer or the physicist—the operative will increasingly be a mechanical rather than a metallurgical craftsman, with the developing emphasis on mechanical handling in the metal industries.

Reviewing half a century of progress in non-ferrous metals technology, Mr. Bailey concentrated on detailing the increase in the scale on which the main wrought products of the industry are manufactured, and the improvement in the quality of production compared with 50 years ago.

He said that it was not easy to compare in detail the practices of to-day with those of 50 years ago, because the industry had virtually been transformed during that time and many things done to-day had no counterpart in 1908. Mr. Bailey stressed the tremendous increase in production, and the enormous extent to which scientific knowledge had been incorporated into industrial practice with a resulting improvement in the quality of materials. He commented upon the vast expansion of the range of products of the industry, and the considerable increase in productivity without which costs would have risen to astronomical heights with present labour prices.

These advances in output and quality had been accompanied by big improvements in working conditions in the industry. Occupational illnesses had greatly decreased and the comfort and facilities available for staff had improved out of all recognition.

He continued by saying that even further progress was being made, and that the engineer was continually asking for better materials, and the metal manufacturer searching for more economical production methods and improved quality of product. The institution of continuous batch processing, and production mechanization, would increase, he predicted, as would the application of continuous automatic control and inspection.

Commenting upon the fact that metal working and handling plant had improved enormously in all respects, Mr. Bailey gave as an illustration the high standard of mechanization obtained in the manufacture of titanium, in which the operator of the furnace was out of physical sight of the actual furnace.

Another speaker, Lt. Col. S. C. Guillan, said that membership of the Institute now totalled 5,001. He also intimated that the Council of the Institute had accepted the invitation of Sweden and Denmark to hold the next autumn meeting in Scandinavia, starting in Stockholm on September 21, and ending at Copenhagen on September 29, 1959.

Foundry Industry in Scotland

Trading conditions in the Scottish iron foundries have been quiet, with isolated instances of works having to close down temporarily through lack of orders. The average working week is no more than four days at present and some foundries have had to cut back to three days. There are others, however, which are still operating the full five days each week and expect to be able to continue so in the months ahead.

No great distinction can be made between foundries catering for the general engineering industries and those specializing in the manufacture of domestic appliances and fitments, except perhaps that the latter group is more directly concerned with the volume of new buildings erected. The more highly-specialized foundries, both in the engineering and domestic fields, appear to have suffered more than the others through the downward trend in business over the past nine months, but there are exceptions to this generalization.

As a result of the quiet conditions in the trade, all grades of foundry pig-iron are readily available and supplies of suitable steel scrap are plentiful, but there are some anomalies in the availability of heavy cast-iron scrap. Supplies are said to be short in some quarters, while in other areas merchants find their stocks difficult to move. There seems a distinct possibility of some cast-iron scrap being exported under licence to Continental foundries.

The Worshipful Company of Founders is to have Mr. GEORGE W. ILSLEY, A.C.A., as its next Master. His wardens will be (upper) Mr. C. LITTLER SMITH and (under) Mr. J. C. THOMSON, T.D., M.B.E., M.A.

Birmid Industries' New Foundry in Australia

Survey of Conveyors Installed

A large and highly-mechanized foundry has recently been installed at Geelong, Victoria, New South Wales, Australia, for Birmid Auto Castings (Pty.) Limited, a subsidiary of Birmid Industries, Limited, for the manufacture of automobile castings. The layout and specification were prepared by the group's engineering staff at Smethwick. The core-sand and scrap-sand plants, and various conveyor installations for the cooling of castings, the shotblast plant and for the dressing shop, as well as much ancillary equipment, were supplied by UK concerns. Site erection of the above equipment was carried out by Birmid Auto Castings (Pty.), Limited, under the direction of site engineers. What follows is a brief description of the plant furnished by one of the UK suppliers.*

Core-sand Plant

Incoming wet sand is discharged from tipping lorries into two receiving hoppers, the tops of which are at ground level and are covered by grids of 2-in. sq. mesh. The hoppers are conical in shape and each is fitted at the bottom with a rack and pinion cut-off gate with a tray to collect surplus water, which is piped to a settling tank fitted with a pump for disposal. Sand is drawn from the hoppers by two 4-ft. dia. rotary feed-tables operating at a speed of 5.9 r.p.m. and is conveyed to an oil-fired sand drier *via* an 18-in. wide flat-belt conveyor operating at a speed of 100 ft. per min. and a 10-in. vertical pitched bucket-and-belt elevator operating at a speed of 220 ft. per min. The drier is rated at 4 tons per hour.

Dried sand is conveyed to four 38-ton. capacity storage bunkers *via* a pneumatic conveying and cooling system and an 18-in. wide flat-belt type of distributing conveyor fitted with hand-operated "V" ploughs. Sand is drawn from the storage bunkers and transported to two 10-cwt. capacity Fordath batch core-sand mixers *via* four 24-in. wide flat-belt feeders operating at 80 ft. per min., two 18-in. wide flat-belt conveyors operating at 100 ft. per min. and two 10-in. vertical pitched bucket-and-belt elevators operating at 220 ft. per min. Attached to each elevator casing is a 10-cwt. capacity hopper fitted at the bottom with an electro-pneumatically operated duplex gate.

The electrical control gear is semi-automatic and is so arranged that on the operation of a push button the duplex gate of the batch hopper opens, enabling the material to pass to the mixers, and after a suitable interval, closes. The appropriate feeder or feeders, the belt conveyor and the elevator then start up and run for a pre-determined length of time which is adjusted to supply the correct quantity of sand to the batch hopper. The conveying system then remains inoperative until the push button is again operated. An alternative take-off from the storage bunkers is provided by means of two chutes, discharging to skips running on a rail track.

* New Conveyor Company, Limited.

Waste-sand Plant

Waste sand is received from the knockout and from a scrap-sand grid and transported to an elevated storage bunker of 60 tons capacity, *via* a 36-in. wide flat-belt conveyor operating at 40 ft. per min., a 15-in. wide pitched bucket-and-belt elevator operating at 226 ft. per min. and a rotary sand distributor. Tramp iron is removed and transferred to skips by the conveyor-head pulley, which is of the super-intensity magnetic type. The bunker has two outlets fitted with Newell F.P. patent doors discharging to lorries below.

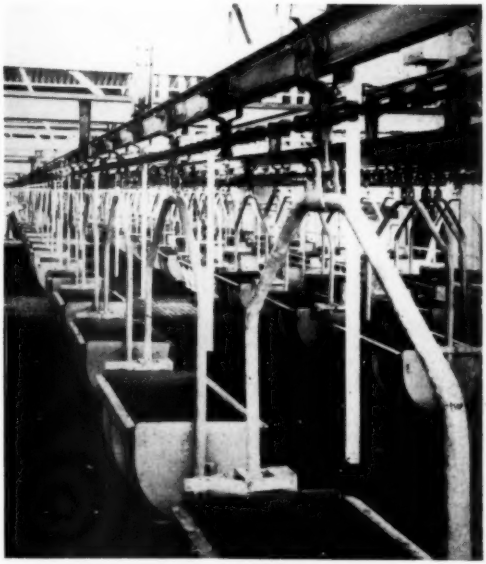


FIG. 1.—*Casting-cooling conveyor of the overhead chain type. Castings are loaded from the knock-out platforms at ground level into buckets suspended from alternate trolleys.*

Birmid Industries' New Foundry

Conveyor Systems

The casting-cooling conveyor (Fig. 1) is of the endless overhead-chain types; it is 1,818 ft. long and operates at speeds variable between 6 and 15 ft. per min. The castings are loaded from the knockout platforms at ground level into buckets suspended from alternate trolleys, which are at 2 ft. 8 in. pitch, the maximum load in any one bucket being 5 cwt. The track rises up into the roof where it forms a series of loops, after which it descends to ground level adjacent to the scrap-sand plant. The casting-cooling conveyor is driven at three positions, each drive incorporating a Heenan dynamatic coupling.

The feeder conveyor for the airless blast-cleaning cabinet is also an overhead chain conveyor, 288-ft. circuit, operating at speeds variable between 2 and 12 ft. per min. and with carriers suspended from trolleys at 2 ft. 8 in. pitch, the maximum load on any carrier being 5 cwt. (Fig. 2). The load carriers are fitted with sprockets engaging with a driven chain, to give carrier rotation during transit through the blast cabinet. Approximately 1,100 ft. of heavy-duty roller track was also supplied by the same firm for the dressing shop, for handling castings up to 3 cwt. each in weight.

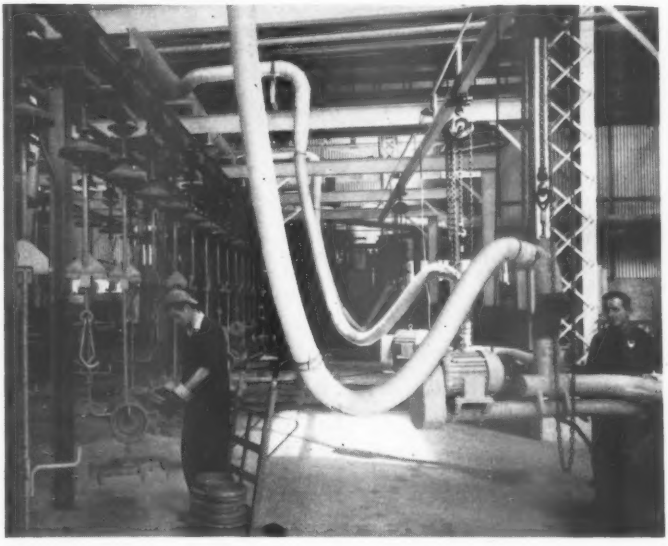


FIG. 2.—*Feeder conveyor (left) for the airless blast-cleaning cabinet. Incidental interest in this illustration is provided by the suspension arrangements and flexible exhaust system for the heavy swing-frame grinders (right).*

ICI Associate's Bid for Hudson & Wright

An offer involving some £746,000, of 6s. 9d. cash per share for all its 2,210,000 ordinary 2s. shares, has been received by Hudson & Wright, Limited, manufacturers of seamless brass and copper tubes, of Birmingham, from Yorkshire Imperial Metals, Limited. The company was formed in January when the copper and copper alloy tube and plate divisions of Yorkshire Copper Works, Limited, and Imperial Chemical Industries, Limited, were merged.

Having agreed that the offer is favourable, the directors of Hudson & Wright are to accept in respect of their own shareholdings and other holders are recommended to do likewise. The offer, which is subject to acceptance being received for not less than 90 per cent. of the issued capital or such lesser percentage as Yorkshire Imperial Metals may agree to accept is subject to irrevocable acceptance on or before October 13.

BSI Kite Mark

The British Standards Institution magazine for August announces an alteration to their well-known kite mark. In future the mark will occupy the centre of a circle, around the inside perimeter of which are the words " Approved to British Standard." The Editor of the JOURNAL deems this to be a distinct improvement.

August Index for Raw Materials Prices Unchanged

During August the general level of prices of basic raw materials, other than fuel and foodstuffs, remained unchanged, but prices of fuel used in manufacturing industry were slightly higher, chiefly because of increases in fuel oil prices. According to the Board of Trade's provisional index, increases in the prices of copper and raw rubber were offset by decreases in the prices of other commodities.

The index numbers for materials and fuel used in the mechanical engineering and electrical machinery industries rose slightly—by 0.2 and 0.4 per cent., respectively. This was due mainly to increased prices for copper and brass items.

British Pumps for West Germany's New Reactor

Following immediately upon the second International " Atoms for Peace " Exhibition at which the company was exhibiting, Hayward Tyler & Company, Limited, members of the Platt Brothers Group, have received instructions to supply three heavy-water main-coolant glandless circulators for the German materials-testing reactor to be built at Julich in the German Federal Republic. These units are similar to those supplied for the Dido, Pluto, Dounreay, Lucas Heights and Riso reactors designed by Head Wrightson Processes.

Wasting of Capital Assets

Current Application of "Allowances" Principle

By T. J. Sophian

One of the problems with which both commercial interests and the revenue authorities are confronted is whether it should be a general principle of the taxation of profits that allowances or deductions should be made for the wasting of assets that are employed in the undertaking which produces the profits. In what follows the various aspects of this question, particularly those which affect foundrymen, are put into proper legal context.

Modification of Basic Principle

Originally the income-tax code strictly adhered to the principle that no relief should be given for the wastage of an asset which was used up in the course of carrying on a business. Such wastage which is caused by the use of the asset is to be kept clearly distinct from a diminution in the value of an asset brought about by changes in the value of money, or other such extraneous factors. The latter will not be dealt with here and the observations which are made in this article relate only to diminution in value produced by use of the asset and its wastage in the process.

This basic principle of the income-tax code—that no allowance should be given for wastage of capital used in producing profits—was relaxed for the first time in 1878, when allowances could be claimed in a limited class of case for wear and tear. The relief, however, was limited to machinery and plant, and it was somewhat grudgingly granted in deference to the varied practices that had grown up. It was, however, somewhat liberally construed as extending to expenditure on renewals and replacements of plant and machinery.

From this beginning the next step was to grant relief for obsolescence. This relief was distinct from wear and tear allowances for whilst the latter was intended to meet the diminution in value of the asset consequent on its use in the business, the former were intended to meet its diminution, or even complete loss of value, because of the introduction of more modern and efficient plant and machinery. At first the relief for obsolescence was given since 1897 as an administration concession, but it was not until the Income Tax Act of 1918 that it was formally clothed with the authority and sanction of statute law. The relief, it may be observed, was calculated as being such part of the cost of replacement as was equivalent to the written down value, less any sum realized by the sale of the old plant and machinery.

Mills, Factories and Similar Premises

A further inroad into the basic principle denying relief for wastage of capital and by reason of their use was made at the same time by the Income Tax Act 1918. It was recognized that certain classes of premises were more likely to depreciate—and to depreciate at a more rapid rate—by reason of the particular uses to which they were put.

Vibration by the employment of plant and machinery was perhaps the chief element taken into consideration. This exceptional wear and tear for which relief was given to foundries, factories and similar premises was given a special allowance equivalent to one-sixth of the gross Schedule A value.

Wastage of capital assets, according to the views of the 1920 Commission on the subject, falls into four principal categories:—(1) Inherently wasting assets produced by the expenditure of labour and capital (such as machines), (2) inherently wasting material assets consisting of natural resources (such as mines or sand and gravel pits), (3) wasting rights to material assets (such as a lease of lands), (4) wasting rights to immaterial assets generally of limited duration (such as patent rights).

Post-war Reliefs

The post-war tax legislation appears to have recognized as a general principle that taxable profits should be determined only after all proper deductions and allowances, including allowances such as might be expected to be made on a commercial basis for the amortization of money expended on assets which are used up in the making of profits. For this purpose it would seem there can be no logical distinction between inherently wasting assets on which labour or capital has been extended (classification (1) above) and inherently wasting material assets consisting of natural resources only (classification (2) above).

Parliament, however, was not prepared "to go the whole hog" in the application of this principle, and its practical endorsement of it was very niggardly. The provisions of the Income Tax Act 1945, which introduced the reforms, and which were designed to stimulate development in these particular spheres, were limited to five main classes of expenditure, *viz.*, on:—(*a*) industrial buildings and structures; (*b*) plant and machinery; (*c*) exploration, development and construction work in mines, oil wells and other mineral sources; (*d*) agricultural buildings and works; (*e*) patent rights and (*f*) scientific research.

The Act of 1945, moreover, was responsible for the introduction of a new kind of allowance, limited however, to certain classes of assets, *viz.* the "initial allowance." This allowance was to be made once and for all on the acquisition of the particular capital asset. It was distinct from and additional to, the annual allowance representing the wear and tear of the asset. In this way the writing off of an asset was accelerated and the whole scheme was

Wasting of Capital Assets

rounded off by the system of balancing charges and balancing allowances, which were to be made on *inter alia* the disposal or destruction of the asset.

The object of these charges and allowances was to prevent the taxpayer, according to the price realized on the resale and the extent of reliefs already given, from enjoying a surplus of relief, on the one hand, or on the other, of suffering a lesser relief on the subsequent disposal of the asset.

The initial allowance given once and for all in the first year was clearly not measured by the extent of the depreciation of the asset in the first year. It operated, in effect, as an advance payment of the capital allowance in respect of the asset, which would ultimately become due, so that in this respect it may be regarded as ranking, like the annual allowances, as an allowance for depreciation.

Investment Allowance

A new allowance, largely supplanting the previous initial allowance, was introduced in 1954 with regard to capital. It was in substitution of the initial allowance on expenditure which could have been formerly claimed, including capital expenditure on:—(*a*) machinery and plant dealt with on the renewals basis; (*b*) agricultural buildings and works; (*c*) buildings, machinery and plant for scientific research and (*d*) cutting, tunnelling and levelling land in connection with the construction of an industrial building or structure.

Capital expenditure on (*a*) motor cars not used for a hire business; and (*b*) *secondhand* machinery and plant was, however, excluded but such expenditure, if it would have qualified for the old initial allowance, will still continue to qualify therefore. From this brief summary it will be seen that the scope of the reliefs is still very limited. Undoubtedly there is a great deal of hardship which is still suffered by the inability to make deductions for the diminution of the values of wasting assets.

B. Elliott & Company to Issue Interim Report

Chairman of B. Elliott & Company, Limited, London, N.W.10, Mr. J. Frye, says that there was a considerable fall in the value of orders for machine tools at home and abroad in the last few months of the year to March 31, 1958, and that trend has continued in the current year. This year's sales are in advance of those of the corresponding period of last year and it is hoped that this improvement will be maintained throughout the active selling season which starts in the autumn. In Canada and the USA, results of subsidiaries have not been up to expectations, and heavy expenditure incurred has not been fully covered by revenue.

In view of the uncertain outlook it is hoped to issue an interim progress report and this is intended to become an annual feature. Group net profits fell from £211,335 to £85,806 in 1957-58, and the dividend is unchanged on a larger capital at 30 per cent.

Diploma in Technology

The National Council for Technological Awards recently announced the names of the first 34 students to be awarded the new Diploma in Technology. These 34 young men become the first to be entitled to put the letters "Dip.Tech.(Eng.)" after their names and to obtain a status in this particular field equivalent to a university honours degree. For the beginning of the Diploma in Technology one must go back four years when, at the suggestion of the General Electric Company, Limited, a four-year course was prepared by Birmingham College of Technology.

Of the 40 students who took the finals in July, 28 reached honours level, seven reached pass level and only five failed. The 34 successful students are all student electrical apprentices with GEC and all have completed an approved four-year sandwich course comprising alternate six-month periods of study at Birmingham College of Technology and of industrial training at the GEC works.

These first results—the GEC course is a year ahead of any other in the country and was set up before the NCTA awards were established—are regarded as a significant stage in the Government's plan for doubling the number of technologists. There seems to be every likelihood that by the end of 1961, 1,000 or more students will have qualified for the diploma and that this figure might well increase to 2,000 by the end of 1962. Further courses are expected to be recognized in the next academic year, although some will depend on the colleges being able to recruit qualified and experienced staff. So far more than 50 courses in a wide range of subjects have been recognized by the council as leading to the diploma.

The subjects of the examination were electrical engineering, mathematics, human relations, and industrial relations, together with two of the following subjects:—Electrical measurements and measuring instruments; electric power; applied thermodynamics; theory of electrical machines, electronics, and telecommunications.

To-day there are 1,394 students in all, from such firms as the Birmingham Small Arms Company, Limited, Imperial Chemical Industries, Limited, the British Motor Corporation, Limited, and Tube Investments, Limited. The largest number of students, 498, are taking electrical engineering with mechanical and production engineering only two behind at 496.

Automatic Welding of Aluminium Plate

The Northern Aluminium Company, Limited, at their Rogerstone works, near Newport, Monmouthshire, have successfully developed automatic welding of aluminium plate to give sizes of up to 30 ft. by 11 ft. on a production basis. Noral plate in thicknesses up to 0.4 in. is butt-welded by means of a type "C" Argonaut head mounted on a motorized tractor—supplied by British Oxygen Gases, Limited. A welding jig holds the two plates flat with the required welding gap and the self-propelled carriage moves along the seam at speeds of between 15 and 150 in. per min. The process is said to give consistently sound results and complete freedom from distortion.

Mr. J. C. DICKINSON has been appointed shipbuilding manager of Scotts' Shipbuilding & Engineering Company, Limited, Greenock (Renfrewshire).

Equipment and Supplies

Industrial Inspection Kit

In these days the care and attention to detail in foundries, quite apart from research of all kinds, has necessitated new methods of inspection. To meet such requirements, the "Ellispection" kit (Fig. 1) is being manufactured and marketed by the Ellis Optical Company, of Mayday Road, Thornton Heath, Surrey. It comprises a series of rigid and flexible probes with

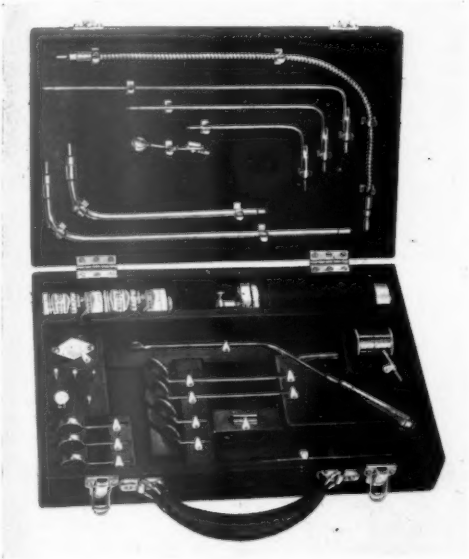


FIG. 1.—*"Ellispection" industrial inspection kit.*

fixed and movable mirrors, magnifiers and midget-battery-operated electric lights, the smallest being $\frac{1}{4}$-in. dia. It has possibilities for use in the examination of the interiors of intricate castings.

Pipe-cleaning Tools

Consolidated Pneumatic Tool Company, Limited, 232, Dawes Road, London, S.W.6, have published details of a new range of tube-cleaning equipment (illustrated in Fig. 2). The range, known as "Lagonda," includes three sizes of vane-type air-motors available to operate a variety of cutting heads for dealing with straight or curved pipes from $\frac{1}{2}$ in. to 6 or more inches inside diameter. A wide selection of cutter heads and brushes is available, which, it is considered, may have considerable application in the production of cast pipes.

Magnetic Drum

As a result of the development by the Philips organization (in this country, Philips Electrical, Limited, Shaftesbury Avenue, London, W.C.2) of ceramic magnetic materials, it has become possible to produce a drum which is highly magnetic over its entire surface—a distinct advance upon conventional drums which normally use horseshoe-type magnets cast in steel and encased in a non-ferrous cylinder. The firm's "Magna-Drum" has no such enclosure to restrict its magnetic field.

At present, the development has been applied to coolant clarifiers, and in this application it is claimed that the drum's magnetic field is so intense and the fluid to be filtered so controlled, that a high proportion of grinding abrasive is always contained in the swarf collected on the drum's surface. The swarf is removed by specially designed scrapers. The complete range is designed to handle flows of 300-5,000 gall. per hour.

YALE & TOWNE MANUFACTURING COMPANY, British Materials Handling Division, Wednesfield, Wolverhampton, announce the production of a new all-weather electric fork-lift truck. It is Yale series 51 and is of 8,000 lb. capacity fitted with an adaptable jib attachment.

WESSEX INDUSTRIES (POOLE), LIMITED, Dolphin Works, West Street, Poole, Dorset, announce an addition of a new model, No. E755, of their Wrigley reach-fork-lift truck, the advantages of which are that the truck can be used in narrow gangways and its height is such that it proves specially useful where headroom is limited. Safety and manœuvrability have received particular attention in the design.

E. BOYDELL & COMPANY, LIMITED, Old Trafford, Manchester, 16, announce a new model of the Muir-Hill LH-1 diesel hydraulic loader in which a new engine (the Perkins P3 (144)); improved weight distribution; and better access to the gearbox and clutch are provided, and a neater appearance is given by using a radiator of lower height. In addition, the beam guides have been removed, and the front panel and buffer integrated.

FIG. 2.—*Consolidated Pneumatic's Lagonda tube-cleaning equipment showing examples from the* 600 *series (smallest motor);* 1100 *series (centre) and the* 1300 *series.*

Notes from the Branches

London

The first meeting of the 1958/59 session of the London branch of the Institute of British Foundrymen was held on Wednesday, September 24, at the Constitutional Club, Northumberland Avenue, London, W.C.2, when about 100 members and visitors were present. In the absence of Mr. A. Talbot (the outgoing president), Mr. Geo. C. Pierce introduced the new president for the coming session. He said that Mr. D. E. B. Barnard had many foundry associations and was well qualified to occupy the chair, and that he took much pleasure in investing him with the badge of office.

Mr. Barnard acknowledged these kind remarks and said how much he was looking forward to his year as president, and asked Mr. Pierce to occupy the chair for the remainder of the evening.

The president chose the subject of "Good-housekeeping" for his address and suggested various ways in which this could be carried out in foundries. Amongst the points mentioned, he suggested clear roadways, the greater use of hoppers and bins for foundry sand, clear melting areas, great attention to ladle preparation, and good pouring aisles. When pouring, he suggested that the runner cups should be arranged at about the same height and this often saved metal spillage. The knock-out should be concentrated in one area of the foundry, and it was also advantageous to have the shotblasting carried out in a separate building; here, too, the runners and heads could be removed. He stressed the importance of the use of quality small tools and plant, especially patterns. Dust extraction was referred to—it was vital to ask "to where does the dust go?," *i.e.*, dust separation was just as essential as exhausting the dust-laden air. The importance of reclaiming gaggers, core-irons, sprigs, etc., was mentioned, Mr. Barnard saying that it was quite as easy to collect them as to scatter them about. In the fettling shop, he stressed the necessity for the use of safety boots and goggles. Heating, lighting, ventilation and decoration were other points mentioned. For heating, he said that radiant panels had been proved very suitable, coke stoves needed much attention. In his foundry, roof glass was more of a liability than an asset, but fluorescent-tube lighting, below crane level, was excellent. The natural-draught type of ventilation system for the foundry itself he had found to be good, but it needed expert installation. Finally, he stated that "good-housekeeping" "started from the top"!

At this juncture, a film fully illustrating the processes and plant at Textile Machine Works large modern mechanized foundry in America was shown. This provided a good illustration of the practical application of the precepts outlined by the president in his address.

Quite a lively discussion followed, during which such topics were dealt with as the efficiency of grinder exhaust-systems; side-window or roof lighting; how to inculcate tidiness among personnel; application of "good-housekeeping" to very small foundries, and the progress already made. A vote of thanks to the president was warmly accorded on the proposition of Mr. A. W. Bartlett, seconded by Mr. L. A. S. Harbourne.

South Africa

There was a near-capacity attendance at the August meeting of the South African branch, held in the Pharmacy House Auditorium, Johannesburg, when Mr. R. T. Rounce, presented a paper entitled "Foundry Organization." Mr. R. C. Cross, branch president, was in the chair.

Mr. Rounce said that the main requirements for organizing the work of a foundry were technical knowledge and experience; a grasp of efficient methods of production; and the ability to handle people. Foundry organization, he said, could be subdivided into the three parts—technical, production and personnel control.

First discussing technical control, Mr. Rounce said he considered this could be dealt with under the headings of quality of workmanship, of material, and of control. He then listed the essential tools, such as moulding boxes, sand, patterns, etc., and gave it as his opinion that providing the correct tools were used, results were bound to be gratifying. On the subject of moulding boxes, he spoke about the types available and summed up by stating that it paid to have the best possible boxes. These were an expensive item and should be treated with care when knocking out. He thought that a fitter should be employed to organize a regular periodic inspection, preferably checking the boxes against a jig for the correction of faults.

Mr. Rounce encouraged every foundryman to acquaint himself with the working of a sand-testing apparatus, at least that of a simple nature, such as for determining moisture, permeability and strength testing, and emphasized that it was important to know the effect of the properties of sand on castings. As to the organization of pattern storage. Mr. Rounce suggested that this was essential in the foundry itself, and perhaps not quite so necessary in a store-room where a pattern might lie for months. Every moulder, he said, should have a shelf, or an area in the case of a large works, where he could keep patterns not actually in use, and the management should insist that they were replaced after each time of use, also each machine should have a rack nearby for pattern plates.

Rational Work Organization

Having established that the proper tools were available, the author said the next step was to ensure that everybody knew exactly what was to be done and how to do it. Unfortunately, the original working method, whereby the foundry foreman advised the moulder on each stage of production was not adopted nowadays to the extent it could be, due no doubt to the fact that foundry practice had become a science which required considerable study and experience. The outcome was that the expert foundry technician had now come into being and instructions came from him, whether he was a manager, foreman, methods superintendent, technician, etc. Mr. Rounce emphasized the importance of providing method-cards for every job, or at least for the most important ones, as this system provided an invaluable record which could be filed for re-use when the job returned at a later date.

Mr. Rounce then dealt with production control: planning production; progressing production and personnel control, concluding by quoting the well-known expression "a man cannot serve two masters." In his opinion, he said, the only "master" should be the company for whom a man worked, and self-satisfaction engendered by having done a fair day's work.

The discussion was opened by a contribution from Mr. H. A. Godwin, a past-president of the branch, and concluded with a vote of thanks by Mr. F. C. Goldsmith. Mr. Goldsmith who has been transferred from the Birmingham branch of the Institute, brought greetings from that branch, and congratulated Mr. Rounce on an excellent paper.

Inverse Greyness in White-iron Castings . . . . .

. . . . Related to Delayed Cooling Near the Surface

Letters to the Editor, appearing in the *Journal* of the Iron and Steel Institute, contained the following of interest to foundrymen:—

In a recent paper by Thyberg[1] possible causes of inverse greyness in white cast iron (*i.e.*, a surface rim with flake graphite in a white-iron casting) have been discussed with reference to temperature measurements carried out by the present writer. The results indicated that the cooling rate at the critical eutectic temperature range was lower just below the surface than it was in the interior of the casting. The occurrence of graphite near the surface is therefore related to the cooling rate. Since the phenomenon may be of general interest from the point of view of solidification of castings, some details of the experiments will be given here.

The cooling rate at different depths below the surface of a horizontally-cast white-iron cylinder, 30 mm. dia. by 15 cm. long, was studied by recording the temperature indications from two Pt./Pt.-Rh. thermocouples. These were placed longitudinally in the cylinder at different distances from the surface, their junctions being located at the middle of the cylinder length. The couples were made of 0.35-mm. wire, protected by capillary silica tubes of 0.40-mm. bore and 0.90-mm. o.d. The thermocouples fitted snugly in the tubes, ensuring the fastest possible rate of heat transfer from the surrounding metal. Bare junctions or a thin covering of Alundum cement instead of silica were found to have no advantage. The temperature was registered by connecting the two thermocouples alternately to a recorder capable of making a full movement from 0 to 3 mv. in 0.8 sec. The metal cast was a malleable iron with 2.6 per cent. C. and 1.8 per cent. Si., melted in an induction furnace from raw material of commercial purity.

One of the thermocouples was usually located 1 mm. below the surface and the other was placed at varying depths between 5 and 9 mm. The cooling curves obtained had the well-known general shape showing the crystallization of austenite and the eutectic arrest. However, in the temperature range just above the eutectic arrest it was found that the cooling rate at the junction located adjacent to the surface of the specimen, contrary to what might be expected at first sight, was consistently less than in the interior. It should be pointed out that the specimens had a white structure throughout.

Analogous Cases

Similar cases of an "inverse" relationship between the cooling rates in the interior and in a surface zone can be found in Russell's simplified calculations of the cooling process in steel ingots[2] and also in Paschkis's studies on the solidification of castings by means of analogues.[3] Direct evidence of a lower cooling rate at the surface in certain temperature ranges during freezing can be derived from cooling curves in the work of Brandt, Bishop, and Pellini.[4] Adams has argued[4] that an increase in linear freezing rate at a late stage of solidification may be a normal process in castings. Some of the present writer's additional arguments on this point have already been elaborated by Thyberg.[1] In short, the required change in rate of cooling in a surface layer relative to the interior may be due to the fact that the initially rapid dissipation of heat from the surface zone outwards is slowed down considerably, owing to the rapid increase in the temperature of the surrounding mould, the rate of heat transfer from the interior being less affected by the rising mould temperature.

Other Observations

The demonstrated fact that the cooling rate in the temperature range which is critical for the crystallization of the eutectic was lower in the surface layer than inside may explain the occurrence of inverse greyness in white iron. If the composition of the iron and the cooling rate in the interior are well balanced so as to give a white structure verging on grey in the interior, the delay in cooling at the surface might well be thought to cause graphite to form instead of cementite. Inverse greyness should then be promoted by such factors which tend to give a rapid initial increase in mould temperature. The fact that a high pouring temperature of the iron favours inverse greyness is in accordance with this hypothesis. It is believed that other factors which have been found to influence the tendency towards inverse greyness do this indirectly. Inoculation from the mould, which has sometimes been considered responsible for inverse greyness, was found by the writer to be an inessential requirement, since a grey surface rim could be produced even in castings which were open to the air.

Since the first publication[1] of the findings reported here, indications of the same effect have also been found by Moore.[5] A full report of the present investigation has been published.[6]

This letter is published by permission of the Association for Metal Transforming, Mechanical and Electro-mechanical Engineering Industries, Stockholm, Sweden, with which the writer was associated at the time of this investigation. The writer is indebted to Professor E. Rudberg of the Institute for Metal Research for encouragement and the provision of equipment.

The letter appeared above the signature of Gustaf Östberg, writing from Falu Kopparverk, Falun, Sweden.

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5 C. T. Moore, BCIRA, *J. Res. Dev.*, 1957, **7**, pp. 68-79.
6 G. Östberg and C. E. Gustafsson, *Gjuteriet*, 1958, **48**, pp. 8-11.

Personal

Mr. ALEXANDER BOYT has been co-opted to the board of Buck & Hickman, Limited.

Mr. R. E. HUFFAM, a director of Unilever, Limited, has been elected president of the British Standards Institution.

Mr. C. A. HENDERSON has been appointed general manager of the Eutectic Welding Alloys Company, Limited.

Mr. J. S. WOODROW, who resigned as managing director of the Pulsometer Engineering Company, Limited, last July, has now resigned from the boards of the company and its subsidiaries.

Dr. D. G. SOPWITH, head of the Department of Scientific and Industrial Research at East Kilbride, is one of the 74 new Justices of the Peace appointed for the county of Lanarkshire.

Mr. LEONARD BAKER has been appointed deputy managing director of the Coventry Gauge & Tool Company, Limited. He is relinquishing his directorship of Hamworthy Engineering, Limited.

Mr. GEORGE H. HERRING, shipyard manager and a director of Richards Ironworks, Limited, has been appointed managing director. The company is a subsidiary of the United Molasses Company, Limited.

Mr. R. YEOMAN, foundry manager for James Hodgkinson, Limited, mechanical stoker manufacturers, Ford Lane Works, Pendleton, Salford, has been appointed general manager of the foundries of the group.

Mr. JEFFREY R. EDWARDS, superintendent of the Shepcot Lane Rolling Mills, Limited, a subsidiary of Firth-Vickers Stainless Steels, Limited, Weldon Street, Sheffield, has been appointed a special director of the company.

Mr. CYRIL E. LLOYD will retire as chairman of N. Hingley & Sons, Limited, makers of wrought-iron bars, rollers of steel bars, etc., of Netherton, Dudley (Worcs), as from January 1, 1959. He has held this position for over 40 years.

Mr. H. S. "DICK" BROOM has been elected chairman of Broom & Wade, Limited, in succession to the late Mr. HARRY S. BROOM. Mr. C. BROOM SMITH has been elected deputy chairman. Both remain joint managing directors.

Mr. DUNCAN FOSTER (inspector) and Mr. HAROLD THROUP (maintenance staff) have been presented with gold watches on completing 35 years' service with Frank Wigglesworth & Company, Limited, engineers and millwrights, Clutch Works, Shipley, Bradford.

Mr. RICHARD TURNER has been appointed a director and a managing director of Johnson Matthey & Company, Limited. He has relinquished his position as managing director of Mallory Metallurgical Products, Limited, a subsidiary of Johnson Matthey, but remains a director.

Mr. D. HADDON, chairman and joint managing director of the Stafford diesel-engine manufacturers, W. H. Dorman & Company, Limited, and Mr. J. W. WHIMPENNY, joint managing director and general manager of the company, are undertaking an overseas tour covering Canada, Australia, New Zealand, and South Africa.

Mr. WILLIAM FODEN, governing director of Fodens, Limited, manufacturers of commercial and motor vehicles, of Sandbach (Ches), who celebrated his 90th birthday on September 16, is said to be Britain's oldest industrialist. He is the son of the founder of the firm. Mr. Foden is still busy every day at his office.

Sir JOHN FORSTER, K.B.E., Q.C., has been reappointed President of the Industrial Court for a further period up to December 31, 1960. The Industrial Court is the independent body to which industrial disputes are referred for arbitration, under the Industrial Courts Act, 1919, in cases in which both parties to a dispute assent to this means of settlement.

Mr. W. J. VAUGHTON and Mr. A. E. THOMAS, both directors of the Delta Metal Company, Limited, have been appointed to the board of James Booth & Company, Limited. Mr. Vaughton has also been appointed joint managing director of James Booth in place of Sir HORACE CLARKE, who has relinquished this position to reduce his commitments. Sir Horace continues as chairman of the company.

Sir ROBERT ROBINSON, FRS, the distinguished scientist, has been elected to succeed Mr. H. Greville Smith, Montreal, as president of the International Society of the Chemical Industry. Sir Robert, who is a director of the Shell Chemical Company, Limited, is a former president of the Royal Society and the British Association and has been awarded honorary doctorates by no fewer than 19 universities.

Mr. WILLIAM SWALLOW has been elected chairman of General Motors, Limited, a UK subsidiary of the US General Motors Corporation, in succession to Mr. G. N. VANSITTART. Mr. Vansittart retired from the board at the end of last month and has also relinquished his chairmanship of Vauxhall Motors, Limited, another General Motors Corporation subsidiary. Mr. Swallow will continue as managing director of General Motors.

As a result of recent changes in the by-laws of the American Foundrymen's Society, four of the headquarters staff have been elected officers by the national board. Mr. WILLIAM W. MALONEY, LaGrange, Illinois, general manager, continues as the chief of the administrative officers of this international technical society of the metal castings field. Mr. S. C. MASSARI, River Forest, Illinois, will hold his former title of technical director. Two other staff members, however, have taken new posts within the past six months: Mr. EDWARD R. MAY has been elected treasurer of the American Foundrymen's Society. Mr. May first joined the Society in 1952 as an accountant and, prior to his recent election, served as assistant treasurer; Mr. ASHLEY B. SINNETT has been elected secretary.

A tribute to Sir HUGH BEAVER for his part in the work which eventually culminated in the passing of the Clean Air Act is his nomination as president of the National Society for Clean Air. Sir Hugh's year of office will also be the diamond jubilee year of the campaign for clean air and it is to be celebrated by an international conference and exhibition to be held in London. Sir Hugh, who is 68, was chairman of the Government committee on air pollution of 1953-54, many of whose recommendations were embodied in the new legislation. His association with the Federation of British Industries was marked last year by his election as president and among many other offices, he is vice-president of the British Institute of Management, director of the Colonial Development Corporation, chairman of the Industrial Fund for the Advancement of Scientific Education in Schools, and a member of the Council of the Institute of Directors. When Mr. Henry Brooke, Minister of Housing and Local Government, set up the Clean Air Council in May, 1957, Sir Hugh was appointed one of its founder members. He is managing director of Arthur Guinness, Son & Company, Limited, and its subsidiaries, and a director of Richard Thomas & Baldwins, Limited.

Book Reviews

Electric Furnaces. Edited by C. A. Otto; published by George Newnes, Limited, Tower House, Southampton Street, Strand, London, W.C.2; price, 35s. net.

This book is compounded of 14 chapters written by specialist contributors, three of them being by the Editor himself. It is one of a technical series, and its purpose is to describe simply the application of electrical heating in various expanding industries. Besides the melting and heat-treatment of metals there are chapters dealing with glass production, vitreous enamelling, pottery firing and the fabricating and moulding of plastics. Apart from chapter I which deals with electrical principles in an elementary way, the rest of the work is descriptive. In this respect the text is supported by plenty of good illustrations and diagrams.

Each chapter considers generally the economical aspect of electric heat as compared with other sources, but the price of the current cannot of course be given. The ironfounder will be interested in the account of vitreous-enamelling furnaces, and of the elimination of a colour-matching inspection department in a works which turned over to electric heating. The steelfounder is provided with an up-to-date account of arc furnaces, with particulars of slag and refractories and annealing plant. The use of the rocking-arc furnace in melting iron borings and for duplexing from cupolas for malleable-iron production is outlined. For aluminium die-casting the core-type induction furnace is described.

Only a portion of the 248 pages is devoted to metallurgical work, but the account of high-vacuum melting and casting for industrial purposes commands special attention. This chapter concludes by remarking that the specialized techniques of vacuum melting "will soon be common practice in this expanding and important field of metallurgy." To this extent the metallurgists have been warned!

HUGH O'NEILL.

Adressbuch der Giesserei-Industrie in der Bundesrepublik Deutschland (Directory of the German Foundry Industry). Edited by the Wirtschaftsverband Giesserei-Industrie, Gesamtverband Deutscher Metallgiessereien, and published by Giesserei-Verlag GmbH, 27, Breitestrasse, Düsseldorf, Germany; price D.M. 20.

The first edition of this very useful directory appeared in 1951, and the appearance of the second edition is especially welcome. It follows the same scheme as the earlier one by first listing the various German foundrymen's organizations—of which there are many, but unlike the British they are all inter-connected. Then follows a list of other nations' associations and those for Great Britain are quite well recorded, except for the Ironfounders' National Confederation, where the particulars quoted are much out of date. (It is suggested by the reviewer that in future editions use be made of the list of UK foundry organizations published monthly in the FOUNDRY TRADE JOURNAL). The rest of the book, quite rightly, is concerned solely with Germany: Part I is concluded by a regional list of German foundry concerns; Part II opens with a geographical index, followed by an alphabetical list of foundry firms, extended details of which are given in the geographical sections. The final section is devoted to foundry equipment—sources of supply and advertisements germane thereto. Finally, there is a list of foundry plant and supplies in several languages (including English) covering the products advertised, related to the supplying firms. By and large, it is an excellent directory and unquestionably gives a reliable picture of the whole German foundry industry.

Publications Received

Survey of Manufacturing Activity in Australia. Published by the Industries Division of the Department of Trade. Available from the Public Relations Officer, Australia House, Strand, London, W.C.2.

There is real clarity of presentation of economic facts and figures in this interesting publication. So far as the ferrous foundry industry in Australia is concerned, it is stated that it produces—excluding "tied" shops—castings to the value of £A16,000,000 annually, and employs 8,000 people in 370 establishments. The output of steel castings has increased by 8 per cent. since 1957. In its survey of costs and prices, it is reported that over the past six months, the cost of producing steel castings has fallen slightly, mainly because of increased activity in steel foundries. Price trends have been downwards, especially for contract work, due mainly to keen competition in all States and, to a lesser extent, a slight easing in metal prices. In iron foundries, lower operating levels have added to costs. Competition, even more intense than that experienced by steel foundries, has forced firms to absorb increases and has tended to reduce prices. In ferrous foundries, productivity generally fluctuates slightly with the volume of work on hand. An increase occurring in productivity in steel foundries has also assisted in lowering costs. The dismissal of employees and elimination of overtime in some iron foundries has had an unsettling effect. The ferrous foundry industry feels, however, that provided materials and wage costs remain unchanged during the next six months, costs and prices should be stabilized at about existing levels.

The production of non-ferrous metals is making steady progress in Australia. Copper, zinc and aluminium all had record outputs in 1957, and only lead showed a decrease. The production of aluminium was only started in 1955 and yet last year more than 10,500 tons were produced. This quantity is still insufficient to meet home demands, and last year some 8,000 tons were imported, as was also about 3,250 tons of copper.

Die-casting is now of growing importance in Australia, where production gained a further 5 per cent., last year. The practice is carried on in 150 concerns employing about 3,500 people. Some 5,500 tons of zinc and 5,700 tons of aluminium were used by die-casters. Summarizing for the whole Australian foundry industry, sand castings are made in more than 400 establishments, but about 52 per cent. of the output is concentrated in 32 large foundries.

Foundry Steels and their Application. Published by the British Steel Founders' Association, Broomgrove Lodge, 13, Broomgrove Road, Sheffield, 10.

The layout and standard of English used in this booklet are alike impeccable. However, this cannot be said of the tabular matter where, in one case, *lb.* per sq. in. is quoted instead of *tons*. In another case, tensile properties are reported as so many thousands of pounds per sq. in. which involves a little arithmetic for UK readers to realize exactly what is meant. Additionally, there are other small defects. The reviewer has nothing but praise for the illustrations, their choice and reproduction are both commendable, whilst the pamphlet is extremely well written.

Wiggin Nickel Alloys *v.* Caustic Alkalies. Published by Henry Wiggin & Company, Limited, Thames House, Millbank, London, S.W.1.

This brochure describes the properties of the high-nickel alloys used in the construction of plant handling

Publications Received

caustic soda. Extensive data, giving comparative corrosion rates from a large number of both laboratory and plant tests, form a useful guide in the selection of the best grade of material.

Copper-pricing Systems—An address by Sir Ronald L. Prain, O.B.E., to the Organization for European Economic Co-operation. Available from its distribution and sales service, 33, rue de Franqueville, Paris 16.

This is a very clear exposition of the three prices quoted for copper. They are Katanga or Belgian; London Metal Exchange; and those quoted by the American periodical *Engineering and Mining Journal*. The operations of the three sources are dealt with in detail and buyers of copper will benefit from a perusal of this brochure.

Overseas Review, August 1958. Published by Barclays Bank D.C.O., 54, Lombard Street, London, E.C.3.

The International Monetary Fund must be very important, but the reviewer confesses that until he read the opening article in this issue, he knew very little about it. Now he is a little wiser and in future will not mentally associate it with the European Payments Union. The contents of this magazine are always made up of the Bank's own reports from countries where they operate branches—and these are numerous. They are mainly in Africa, the Mediterranean and the West Indies, but France, Germany, Canada and the United States are also included. It appears that trade in the last named country has taken a distinct turn for the better.

House Organs

ESCO Ladle, Vol. 21, Nos. 7 and 8; published by the Electric Steel Foundry Company, 2141, N.W. 25th Avenue, Portland 10, Oregon, USA.

Two copies of this magazine were sent to the Editor at his request, as it was gathered from the American Press that at an exhibition of house organs this publication had received the highest award. Obviously something out of the ordinary was expected and one of the covers, depicting the white rose of Yorkshire was especially pleasing. This should have appeared on the June issue, but this one was somewhat special as it carried the story of the visit of two of the company's executives to Sheffield and European countries, and the starting up of a new foundry in British Columbia. The remarks these ambassadors have to make are most interesting. Sometimes they were misinformed, however, for instance, they were told that the Croning process was used subject to royalty payments in all the European countries, but this does not actually apply to Great Britain and some other European countries. Still, their remarks make a very interesting story, many of the characters in which are well-known foundrymen. The illustration of these magazines is indeed profuse, and the only known British equivalent in the foundry industry is the *Stantonian*. No doubt from the American point of view the *ESCO Ladle* well merited the award.

Stothert & Pitt Magazine, Vol. 11, No. 1; published by Stothert & Pitt, Limited, Bath.

This magazine is issued for the information of all employees, and as the firm is centred in one town, it can be presumed that the magazine's appeal is not diluted, as is the case where half-a-dozen works are covered. A high standard of editorial has been achieved and, reader-interest is well diversified, and covers a little of history; a good colour-illustrated description of Southampton Docks; stories of what happens to the firm's machinery when installed; a description of new plant (in this issue, a foundry sand plant taken from the FOUNDRY TRADE JOURNAL) and, of course, all the social activities of works' personnel.

Aluminium Courier, No. 49; issued by the Aluminium Development Association, 33, Grosvenor Street, London, W.1.

This issue contains an exceedingly interesting article about aluminium in art. It illustrates Eros in Piccadilly Circus, Diane de Gabies (from the Louvre) and Don Quixote—an American equestrian statue which is particularly pleasing. Bent-wire contraptions do not usually appeal to the reviewer, but a 9-ft. design of a "Christmas Angel," by Miss Clarebout, must be outstanding in its class. Naturally such an article would not be complete without an example of an "abstract" subject, but the writer is still abysmally ignorant as to what this is all about.

Fanfare, No. 101; issued by Woods of Colchester, Limited, Braiswick Works, Colchester.

There is an account with a human interest in this issue of two awards under the firm's suggestion scheme. Mr. E. Parker received £50 and Mr. E. Beard, now an invalid, £20. The report underlines the reviewer's opinion that good suggestions should be well recompensed. A big prize will attract more ideas than pettifogging payments.

Demag News, No. 147, 1957; published by Demag A.G. Duisburg, Germany.

Contained in this issue is an illustrated article showing the firm's association with the supply of electric-arc furnaces. The first one installed by the company was a 30-cwt. plant in 1906, whilst the latest—claimed to be the largest in Europe—is a 125-ton furnace now in operation at the Huttenwerk Rheinhausen.

Foseco Foundry Practice, No. 131; isued by Foundry Services, Limited, Longacre, Nechells, Birmingham, 7.

This issue announces the introduction of a reduced-pressure porosity tester for use with light alloys. It is portable, easy to operate and has been trade marked Porotec. The main article in this magazine is devoted to defects in sterling-silver sheets.

British Consortium's £50,000,000 Deal

One of the biggest contracts yet awarded by the Argentine Government in connection with its new petroleum and power exploitation policy has gone to a British consortium. The companies concerned are Henry Balfour & Company, Limited, General Electric Company, Limited, Mitchell Engineering Group, Limited, W. Press & Son, Limited, and Paterson Engineering Company, Limited.

The total credit extended by the consortium is £50,000,000 spread over five years. The money will be advanced for the acquisition of machinery and other capital goods needed by the Argentine State oil and light and power industries over a period of three years. Repayment will be on the basis of 5 per cent. with the orders, 15 per cent. against shipping documents, and 80 per cent. in equal six-monthly instalments covering five years from date of shipment. The agreement is subject to the approval of the Argentine Central Bank.

Argentina recently announced multi-million dollar agreements for oil development with companies in the US, Belgium, Germany, and Russia.

News in Brief

BOTTOGAS, LIMITED, supplier of liquefied-petroleum gases, is changing its name to Shell-Mex and B.P. Gases, Limited. The registered office remains at Cecil Chambers, 76-78, Strand, London, W.C.2, and products will continue to be marketed under the brand name Bottogas.

AN INDIAN ORDER for 60 large-capacity automatic tipping wagons to be used for handling bulk materials in dock areas has been obtained by Robert Hudson, Limited, Leeds. The order is under the provisions of the World Bank loan arrangements and is worth approximately £100,000

BECAUSE EACH COMPANY'S diesel engines are complementary, representing a power range of 20 h.p. upwards, the English Electric Company, Limited, and W. H. Dorman & Company, Limited, Stafford, have entered into an agreement whereby each will promote the sale of the other's products.

JOHN TAYLOR DUNFORD & COMPANY, LIMITED, engineers' contractors' suppliers, accident prevention experts and insulation engineers, have moved from the premises they have occupied for 45 years in The Wicker, Sheffield, to new prmises at 173, Attercliffe Road, Sheffield, 4, telephone Sheffield 28761/2&3.

THE METAL INDUSTRIES, LIMITED, group of companies has acquired the whole of the share capital of the privately-owned Leeds firm of hydraulic engineers, Towler Brothers (Patents), Limited, and its subsidiary, Electraulic Presses, Limited, in an £800,000 deal. Mr. Frank H. Towler continues as managing director.

A SECOND TRUE FOUNDRY EXHIBITION—that is one covering the actual castings made by the foundry industry—is again being sponsored by the American Foundrymen's Society. It is to be held next year, from April 13 to 17, at the Sherman and Morrison Hotels, Chicago, and is designated the "1959 Engineered Castings Show."

NEGOTIATIONS HAVE BEEN CONCLUDED whereby the "Meba" Maschinenbau of Esslingen sells the Startrite range of vertical sawing machines in Germany, and the Startrite Machine Tool Company, Limited, Bishops House, Gads Hill, Gillingham, Kent, market in the United Kingdom horizontal cut-off handsaws made by their German associates.

ON THE OPENING DAY of the Commercial Motors Show at Earls Court, Leylands Motors, Limited, announced orders worth nearly £3,000,000—overseas orders being responsible for one-third of this amount. Guy Motors, Limited, Wolverhampton, reported a £370,000 order received from T. G. B. Motors, Limited, of Clitheroe, for 180 vehicles of various types.

THE DUKE OF EDINBURGH is to open the coke research centre of the British Coke Research Association at Wingerworth, near Chesterfield, on Friday November 21. Also scheduled to be opened by the Duke on the same visit are the new extension of the Chesterfield College of Technology, and the new research centre of Ferodo, Limited, at Chapel-en-le-Frith.

FORDATH ENGINEERING COMPANY, LIMITED, announce the appointment of Mr. Derek Smith to their sales staff specifically for the development of epoxy-resin patterns. Mr. Smith was previously assistant works manager with Thos. Holcroft & Sons, Limited, Wolverhampton. He will be solely engaged on comprehensive demonstrations in foundries and patternshops of this relatively-new technique.

THE SEVENTH COAL SCIENCE LECTURE of the British Coal Utilisation Research Association is to be given by Sir Charles Goodeve, O.B.E., D.S.C., F.R.S., on October 15, at the Institution of Civil Engineers, Great George Street, London, S.W.1. Sir Charles, who is a director of the British Iron and Steel Research Association, has chosen for his subject "Carbon: The Key to Metallurgy."

A BRASS TAB with "Thos. Firth & Son, Sheffield, England, warranted," printed on it, has been brought up by frogmen from the wreck of the barque Catherine Shearer, which was sunk in Esperance Bay, Tasmania, over 100 years ago. The Sheffield firm, now Thos. Firth & John Brown, Limited, considers the tab was a tally attached to a consignment of their cast-steel bars which went down with the bargue.

BABCOCK & WILCOX, LIMITED, has received a repeat order from C. A. La Electricidad de Caracas, Venezuela, of approximately £400,000 for a large boiler, the third one of this size supplied by the firm to that electricity undertaking, which is responsible for the whole of the electricity supply in the Caracas area. Each of these boilers is 105 ft. in height. All parts of the boiler will be manufactured in the Babcocks works in Renfrew and shipped to Venezuela for assembly on the site.

A THREE-DAY COURSE on industrial and factory law is to be given from October 21 to 23, by Mr. Harry Samuels, barrister-at-law, under the auspices of the Industrial Welfare Society, at Robert Hyde House, 48, Bryanston Square, London, W.1. The course, covering the legal groundwork necessary to industrial managers and executives, is completely up-to-date with the latest changes in legislation, therefore it will also serve as a refresher course for those who have not considered the subject for some time.

FOLLOWING IMMEDIATELY on the Second International "Atoms for Peace Exhibition" in Geneva, at which the company was exhibiting, Hayward Tyler & Company, Limited, a member of the Platt Bros. group, is to supply three heavy water main coolant glandless circulators for the German materials testing reactor to be built at Julich, western Germany. These units are similar to those supplied for the Dido, Pluto, Dounreay, Lucas Heights, and Riso reactors, designed by Head Wrightson Processes, Limited.

THE 1958 SIR ALFRED HERBERT PAPER, entitled "The European Common Market—Its Origins and Implications," will be presented to the Institution of Production Engineers by Sir Cecil Weir, K.C.M.G., K.B.E., M.C., D.L. (past-president of the Institution), at 6.30 at the Royal Institution, Albemarle Street, W.1, on December 11. Admission, to both members and non-members, will be by ticket only, application for which should be made to the secretary, Institution of Production Engineers, 10, Chesterfield Street, London, W.1.

Wild-Barfield Electric Furnaces, Limited, of Watford, announce that the NRC type 912 vacuum-fusion gas analyser for the determination of oxygen, nitrogen and hydrogen in metals is now available as a British-built unit. The equipment is particularly useful because having the ability to analyse very small samples, only a 3.5 kw. induction-heating generator is employed. A demonstration equipment has been installed at Elecfurn Works, Watford, where by prior appointment prospective customers may witness a complete analysis.

IN THE FIRST CASE of its kind to come before the court, Walsall magistrates granted an injunction against a Birmingham firm of metal smelters under the Clean Air Act, 1956. The order requires the

News in Brief

company to prevent a recurrence of nuisance from smoke at its premises. The firm had spent £2,500 on new equipment to reduce smoke, and it was galling to the manager to find the firm proceeded against because of a fire in the open yard. An assurance was given that there would be no more smoke nuisance. The company was ordered to pay £3 11s. 6d. costs.

IN CO-OPERATION WITH THE BOARD OF TRADE and the Birmingham Chamber of Commerce, the Northern Ireland Ministry of Commerce is planning an intensive drive to attract more Midland industry into Ulster, and a campaign is to be launched during the autumn and winter. The Northern Ireland Government has been making a pilot survey of the Midlands during the summer to determine the most effective means of presenting the advantages of transferring factories to Irish sites. To make the move attractive to firms, the Ulster Government is offering to provide factories on rents of only 9d. per sq. ft.; to pay for the removal of the machinery; to give 25 per cent. grants towards the cost of new plant and to give subsidies on fuel bills.

METROPOLITAN-VICKERS ELECTRICAL COMPANY, LIMITED, Trafford Park, Manchester, in collaboration with the Merseyside & North Wales Electricity Board have arranged an exhibition on "Process-heating for Industry," which is currently being held at the M.A.N.W.E.B. Development Centre, Paradise Street, Liverpool (closing date October 10). Metro-Vick's exhibits are mainly concerned with showing how the company's elements can be built into user's equipment, and of particular interest is a complete working paint stoving plant which incorporates the new Metrovick infra-red projector equipment. Other exhibits include a Birlec furnace for heat-treatment of components, and many examples from the range of workshop heating appliances by Barlow Whitney, Limited.

MR. I. A. BAILEY, managing director, and Mr. H. W. G. Hignett, assistant managing director of Henry Wiggin & Company, Limited, Birmingham, outlining details of the firm's £10,000,000 modernization programme, said that by 1965 it was intended that the company, founded in Birmingham over a century ago, will have transferred to Hereford to the re-organized plant which the firm acquired in 1951 from the Ministry of Supply. The labour force, 2,800 at present, including nearly 1,000 workers at the Hereford plant, would be increased to about 3,300, it was stated. On completion of the redevelopment plan, the Hereford plant will cover a 25-acre site and, it is claimed, it will be the most advanced nickel-alloy factory in Europe. The Glasgow plant of the firm is to be closed in gradual stages.

THE CAPITAL OF JOHN LUND, LIMITED, of Cross Hills, near Keighley, has been bought by the Landis Tool Company, of Pennsylvania, USA—and the company's name is to be changed to Landis Lund. Mr. John E. Hill will continue as managing director and Mr. J. H. Smith as director and joint secretary. The chairmanship will be taken over by Mr. M. A. Hollengreen, president of the Landis Tool Company and its United States subsidiary, the Gardner Machine Company. These American companies manufacture automatic cam, crank and multiple-wheel precision grinding machines, and John Lund, Limited, are manufacturers of Precimax precision grinders and fine boring machines.

Film Review

Kings in Industry. Issued by Geo. W. King, Limited, of Stevenage.

This is a 16 mm. black-and-white advertising film describing the King materials handling systems and their applications. It runs for 24 min., with an efficient technical commentary by John Snagge. The film covers the main products of the company, and shows some of their installations actually in operation in British firms. After a brief introduction showing the works and drawing office, at Stevenage, the film leads into a sequence dealing with electric chain pulley-blocks and hoists and their various applications. This range of equipment has a capacity of from 200 lb. to 13½ tons, and is obtainable either with chain or wire rope in a variety of lifting- and creep-speeds, with provision for any special requirements. The second sequence shows under-slung, over-slung and latching overhead cranes, operating in shipyards, engine repair shops and on assembly lines.

The scene then switches to a whale-factory ship in which an overhead conveyor handles whale concentrates. This equipment ranges from 7½ tons to 20 tons capacity. The third sequence features Ski-Wracker stacking and storage units, of up to 5 tons capacity, which have been specially developed to operate in narrow confined spaces. A light type Ski-Wracker has been specially produced to handle loads such as moulds and machine tools, etc. Fourthly, methods of truck towing for warehouses and stores are illustrated, including the Overtug overhead conveyor, which leaves gangways unobstructed. This conveyor is shown in operation at Hepworth & Grandage, Limited. The fifth sequence of the film shows examples of ingenious overhead chain conveyors—some of them automatic—and the many duties they can perform.

The final and longest sequence of the film has been devoted to the vast mechanical-handling scheme installed at the Austin works at Longbridge, where over 17 miles of King conveyors of various types are in operation. The main feature of this scheme is in Stanrun overhead conveyors which feed the production lines in the engine assembly shop. The name Stanrun is derived from the ability of this conveyor to "stand and run," and this is clearly illustrated as it stops automatically beside the operator until he is ready to take the components he requires from the waiting carrier. When this is done he presses the button and the carrier continues on its way to the next operator. Overhead storage of goods until required keeps esential working space clear.

Whilst lacking a profesional finish as far as the photography is concerned, the film illustrates very convincingly the general excellence, and adaptability of King equipment.

International Conference on Gearing

An international conference on gearing, arranged by the Institution of Mechanical Engineers, was held last week in London. At the technical sessions, which took place in the premises of the Institution at 1, Birdcage Walk, London, S.W.1, no fewer than 39 papers were presented, and these well covered the several aspects of the foundry end of gear manufacture. There was a choice of 15 works visits; at least one of those works inspected possesses foundries where gears are cast.

MR. ALFRED SKITT, metallurgical student at Newton Chambers & Company, Limited, has been awarded a pass in the final examinations of the Institute of Metallurgists, and obtained special merit in mechanical and thermal treatment.

Raw Material Markets

Iron and Steel

There is no appreciable change in trading conditions at the ironfoundries, and, generally, a much larger volume of work than is at present available could be undertaken. The light foundries, which have for so long been in the doldrums, are still unable to improve their position with the present moderate demand for light castings. Mechanization has increased their productive capacity appreciably and many plants are only partially employed. Although the easement in the financial restrictions has not yet resulted in improved demand for light castings, it is expected that such trades as building and domestic equipment will eventually benefit by these measures and that their requirements of castings will show some increase on the present moderate demands. Many of the jobbing foundries need more work and most of the textile foundries are in a similar position.

The usage of high-duty castings remains at a good level, and while the engineering and speciality foundries are not now so heavily committed, they are obtaining fairly good outputs. The motor-car trade maintains a good demand, and regular business is forthcoming from many other trades. Machine-tool makers, who report declining order-books, continue to take reduced tonnages of castings and the foundries catering for them are less favourably employed.

Outputs of all grades of pig-iron continue to exceed demands. Basic pig-iron is more than sufficient to meet consumption and stock requirements of the steelworks, whose demands have fallen appreciably due to the reduced call for steel. In the foundry grades producers are unable to dispose fully of their outputs, and after demands have been satisfied it is necessary to place a portion of their production into stock. The low-phosphorus irons are now plentiful and all producers have tonnages to spare, as have producers of the hematite and refined iron grades. High-phosphorus iron is also plentiful. Stocks of all grades of pig-iron at the furnaces have risen appreciably during the last few months, and these are being added to daily. The foundries are not carrying heavy stocks and where supplies are on hand these are being utilized before placing fresh business. The uncertainty in regard to prices and also business is restricting forward buying, which at present is negligible.

Varying conditions of trade are reported by the re-rollers, but most of them are short of work and production is governed by day-to-day demands, with little forward buying. Many of the mills continue on short time and difficulty is experienced in obtaining sufficient work for the reduced working hours. Demands for reinforcing rods keep some of the re-rollers fairly active, but there is little general improvement in the call for small bars and light sections from home sources; export business is difficult to obtain against the present overseas competition.

Steel semis are plentiful and home steelworks could increase deliveries considerably if called upon to do so.

Non-ferrous Metals

Tin remains the centre of interest in the non-ferrous metal market. The initial shock caused by the recent withdrawal of support by the buffer stock manager, which sent the price crashing nearly £100 in one day, has now been largely overcome and the quotation is only about £2 per ton below the floor price of £730 per ton. The important point is, of course, that the present price reflects supply and demand rather than a fictitious quotation attained by special factors. The chairman of the International Tin Council at a Press conference did not give any specific reason for the buffer stock manager's withdrawal from the tin market. But he did say that the withdrawal definitely implied that the original contributions to the buffer pool were exhausted. This did not necessarily mean, however, he said, that the special fund was exhausted as well. More than that the chairman explained that the special fund was not bound by the terms of the tin agreement and it could be used in any way the buffer stock manager deemed necessary. The present position is that the buffer stock manager is to remain withdrawn from the tin market for the time being and no direct market action will be taken to influence the course of prices.

What all this adds up to is that the council believes that the scheme is more or less on the point of beginning to work effectively and, with the export quotas remaining in force and suitable restrictions placed on the imports of Russian metal, the price will rise up to or above £730 a ton. This, of course, assumes that the recent improvement in demand for tin from the UK, the Continent, and particularly from the United States, will continue. If, in fact, demand does remain firm the prospect is that the tin price will soon rise to £780 a ton at which level the buffer stock manager would be able to sell metal acquired from the original contributions. In America the market is reasonably active and the price is around 94½ cents a pound. Stocks of refined tin in LME warehouses at the end of last week totalled 17,528 tons.

Copper is not as good a market as many people thought it would be in the present circumstances. Aside from a probable lessening in demand from the UK, bullish influences in this market include tension in the Far East over Quemoy, strikes at the International Nickel Company of Canada and on the Copperbelt, and the fact that the availability of electrolytic copper in the pipeline is practically exhausted. There is, too, ample evidence of the growing strength of the American economy, which is having a favourable impact on the demand for copper in the United States, where the primary producers' price and that of the custom smelters are both standing at 26½ cents a pound.

Reports from Rhodesia intimate that a more conciliatory atmosphere is emerging and hopes are that a basis for a settlement of the strike will be found shortly. This bit of news has been sufficient to turn the London market hesitant, although the undertone is quite steady. Stocks in the UK at the end of last week were down to 10,521 tons.

Zinc has been a relatively quiet market, although the action of the Mexican Government in banning lead and zinc exports has made for a slightly better market. The US price is 10 cents a pound.

Lead remains featureless and under £70 a ton in London. The Mexican ban on the export of lead did not have much effect, as the statistical position for this metal is very weak indeed. In fact, at the end of July, stocks of lead in the US stood at 211,976 tons, which was more than double those at the beginning of this year. In America the price is 11.50 cents a pound, New York, an increase of ½ cent.

A PARTY OF DELEGATES to the golden jubilee autumn conference of the Institute of Metals, held in Birmingham, on September 24, visited the new £15,000 laboratory block of the Aston Chain and Hook Company, Limited. Mr. Noel Bond Williams, managing director of the company, received the guests. On September 26, about 300 delegates visited the new Hereford plant of Henry Wiggin & Company, Limited, the nickel-alloy company.

Imports and Exports of Iron and Steel in August

The following tables, based on Board of Trade returns, give figures of imports and exports of iron and steel in August. Totals for the first eight months of this year and last are also included.

Total Exports of Iron and Steel

Destination.	Month ended Aug. 31.	Eight months ended August 31.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Channel Islands	376	2,445	3,062
Cyprus	474	8,244	4,627
Sierra Leone	681	9,742	8,960
Ghana	1,455	16,412	9,664
Nigeria	5,327	39,874	44,368
Union of South Africa	5,605	76,700	69,115
Rhodesia and Nyasaland	3,052	46,612	26,072
Tanganyika	1,099	15,938	8,486
Kenya	2,270	36,255	29,267
Uganda	427	2,716	2,278
Mauritius	217	2,373	2,505
Aden	115	2,978	2,151
Bahrein, Qatar, and Trucial States	613	10,951	6,066
Kuwait	4,698	23,412	30,640
India	10,534	177,976	90,690
Pakistan	2,870	43,286	43,269
Singapore	1,961	26,179	23,698
Malaya	1,126	23,696	10,617
Ceylon	2,460	19,128	19,940
British North Borneo	96	2,576	1,500
Hongkong	4,789	60,302	38,157
Australia	9,029	135,094	65,671
New Zealand	18,024	140,591	127,288
Canada	5,196	193,644	123,886
Jamaica	2,348	15,652	13,851
Trinidad	3,160	33,073	34,917
British Guiana	495	5,140	5,227
Other Commonwealth countries	5,001	20,082	25,758
Eire	2,971	27,957	33,638
Finland	6,078	60,201	34,589
Sweden	7,193	73,132	84,941
Norway	6,854	74,618	61,026
Denmark	4,895	74,131	59,906
Western Germany	10,292	6,060	29,426
Netherlands	4,897	70,707	54,594
Belgium	1,205	31,243	15,325
France	1,057	12,782	2,803
Switzerland	405	12,104	7,133
Portugal	789	13,429	9,545
Spain	2,149	28,871	34,501
Italy	8,296	34,355	35,468
Austria	323	3,560	7,255
Yugoslavia	479	6,558	3,001
Greece	871	7,719	9,568
Turkey	242	3,796	3,527
Netherlands Antilles	65	2,391	1,312
Portuguese East Africa	150	3,359	1,684
Egypt	1,196	1,578	11,673
Sudan	3,092	12,563	27,310
Lebanon	213	8,051	8,563
Israel	269	3,147	5,424
Saudi Arabia	138	3,120	3,498
Iraq	3,084	30,338	24,540
Iran	2,046	44,783	23,807
Burma	732	17,463	6,642
Thailand	1,111	5,696	5,024
Indonesia	299	5,427	1,578
Philippine Republic	193	3,390	2,327
USA	5,942	35,340	52,199
Cuba	378	6,062	3,825
Colombia	251	4,540	4,898
Venezuela	3,146	77,852	53,063
Ecuador	118	2,009	2,032
Peru	567	8,832	7,665
Uruguay	22	5,397	722
Argentina	10,588	55,160	95,635
Other foreign countries	16,589	98,715	49,010
TOTAL	202,683	2,167,507	1,795,407

Total Imports of Iron and Steel

From	Month ended Aug. 31.	Eight months ended August 31.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Rhodesia and Nyasaland	245	3,326	4,507
Canada	2,791	32,641	14,769
Other Commonwealth countries and Eire	1,932	17,559	16,847
Soviet Union	250	185,862	107,701
Sweden	2,696	20,580	23,221
Norway	5,472	76,225	50,937
Poland	90	7,364	173
Western Germany	5,688	71,812	54,817
Netherlands	9,376	39,540	98,159
Belgium	21,001	107,980	79,472
Luxembourg	238	18,871	5,053
France	1,503	42,966	15,035
Italy	826	2,840	4,669
Austria	607	51,244	3,629
Japan	312	9,961	2,544
USA	864	188,615	113,675
Other foreign countries	588	17,576	3,598
TOTAL	54,479	894,962	598,806
Iron and steel scrap and waste, fit only for the recovery of metal	3,126	531,300	58,398

Exports of Iron and Steel, by Products

Product.	Month ended Aug. 31.	Eight months ended August 31.	
	1958.	1957.	1958.
	Tons.	Tons.	Tons.
Pig-iron	16,895	84,641	85,629
Ferro-columbium (niobium)	7	75	26
Ferro-tungsten	23	380	409
Other ferro-alloys	240	2,268	2,254
Ingots blooms, billets, slabs, sheets, and tinplate bars	1,159	881	8,311
Iron bars, rods, angles, shapes, and sections	94	1,358	1,096
Steel bars, rods, angles, sections, and shapes	21,857	361,460	227,520
Iron plates and sheets	6	395	2,037
Universal plates	75	4,516	3,206
Steel plates, ⅛ in. and under ¼ in.	870	8,598	5,434
Ditto, ¼ in. and over	10,241	126,128	121,995
Blacksheets and blackplate	15,912	229,032	190,668
Hoop and strip	8,744	63,874	43,936
Tinplate	30,260	277,157	243,848
Decorated tinplate	471	3,603	2,334
Galvanized sheets	8,461	142,303	51,308
Other (incl. tinned sheets, terneplate, and ternesheets)	1,012	13,270	8,920
Railway and tramway construction material	23,089	182,304	175,701
Wire rods of steel (incl. alloy steel)*	1,313	39,705	23,247
Wire	6,782	74,245	68,223
Tubes, pipes, and fittings	51,008	542,465	514,187
Iron castings	3,575	1,204	7,933
Steel castings	203	1,909	1,921
Forgings	386	5,736	5,266
TOTAL	202,683	2,167,507	1,795,407

* The figures for 1958 are not completely comparable with those for previous years.

BRITISH motor-car manufacturers are confident that 1958 will be a record year and that by December 1,000,000 cars will have been produced. Commercial vehicle production also is at a good level.

ASTON CHAIN & HOOK COMPANY, LIMITED, Erdington, Birmingham, have installed a research laboratory at the cost of £15,000.

Company News

PETO SCOTT ELECTRICAL INSTRUMENTS, LIMITED—Mr. W. H. Cork, receiver and liquidator of the company, states that an offer has been received for the business as a going concern, subject to contract, and he has decided to accept it.

RANSOME & MARLES BEARING COMPANY, LIMITED—The year's distribution is maintained at 15 per cent. with a final dividend of 7½ per cent. and a bonus of 2½ per cent., and in addition, having regard to the financial position as at July 1 last, a special interim of 2½ per cent. is declared. Group net profit of £666,581 compares with £411,905.

N. HINGLEY & SONS, LIMITED, manufacturers of wrought-iron bars, rollers of steel bars, etc., of Netherton, Dudley (Worcs)—From October 1 the company is transferring all of the manufacturing side of its business to a wholly owned subsidiary to be called N. Hingley & Sons (Netherton), Limited. As a result N. Hingley & Sons will become purely the holding company for the group.

NEEPSEND STEEL & TOOL CORPORATION, LIMITED—The company is maintaining its dividend at 50 per cent. on its £1,019,249 ordinary capital for the year to March 31, 1958, with an unchanged final of 37½ per cent. As previously, holders of the 6 per cent. cumulative participating shares receive an additional 4 per cent. Group trading profits are down to £1,260,119 (£1,334,118), and the net profit is down to £615,046 (£655,575).

ACROW (ENGINEERS), LIMITED—The total dividend is being raised by 2½ per cent. to 40 per cent. on capital increased to £450,000 by a £50,000 rights issue and a free scrip issue of one new "A" ordinary share for every six ordinary or "A" 5s. shares held, is proposed. The final quarterly dividend for the year to March 31, 1958, is 10 per cent. Consolidated trading profits rose to £636,555 (£604,772), but the net profit is some £16,000 lower at £240,619.

HORSELEY BRIDGE & THOMAS PIGGOTT, LIMITED, constructional engineers and bridge builders, of Tipton (Staffs)—Group profit for the year ended March 31, 1958 advanced to £358,945 (£316,950) and the dividend is 22½ per cent. (same on smaller capital). After tax of £198,971 (£175,826), the net profit is £159,974 (£141,124). The directors warn that there may be some slowing down in certain departments later in the year due to the reduction in the capital investment programme and cancellation or postponement of contracts. Since Mechans, Limited, was taken over last October the works were operating much more smoothly and output had been of record proportions.

Exhibition of British Goods in Cuba

An exhibition of British products is to be held in the Sports Palace in Havana from December 2 to 5. Motor vehicles will constitute about three-quarters of the exhibition, and other exhibits will include agricultural machinery, Scotch whisky and Irish linen. Arrangements for the exhibition are being made by a local committee which includes representatives of the British Chamber of Commerce in Cuba, motor-car and machinery importers and the British Embassy. For further details interested manufacturers and exporters are advised to get in touch with their agents in Cuba. Firms who have no representation should write to the British Embassy, Apartado 1069, Havana, Cuba.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

IRAN, October 22—The Iranian State Railways Administration invites tenders for 160 tons of galvanized cast-iron pipe of various diameters. (ESB/22917/58.)

BURMA, October 13—Tees and cast-iron pipes. (ESB/23634/58.)

USA—Memphis Furniture International Corporation, P.O. Box 358, 715 South Camilla Street, Memphis, Tennessee, have advised the British Consulate-General at New Orleans that they are interested in receiving samples and quotations from United Kingdom suppliers of brass fittings suitable for use in connection with low-quality furniture. Quantities required would be considerable and the US firm will pay net prices. (ESB/23028/58.)

SUDAN, October 21—Requirements of the Ministry of Works Stores Section include the supply of 2,750 No. cast-iron detachable joints for asbestos pipes for direct delivery to Ashghal, Port Sudan. (ESB/22755/58.)

IRAQ, October 15—Supply of air compressors for the Ministry of Defence. (ESB/23085/58.)

SOUTH AFRICA, November 7—Mould-drying ovens. (ESB/23305/58.)

RIPON AND PATELEY BRIDGE, YORKS, October 13—Supply of pumping plant for the regional water supply scheme, phase II, contract No. 7 for RDC. Documents from John H. Haiste & Partners, Belmont House, 20, Wood Lane, Headingley, Leeds, 6. Deposit £3 3s. 0d. cheque.

CEYLON, November 4—Requirements include: machine tools; aprons; gloves; sleeves; goggles; leggings; face shields, and paint spray hoods. (ESB/23563/58/ICA.)

SWEDEN—AB Bil & Truck, Odinsplatsen 9, Gothenburg C, wish to represent a United Kingdom manufacturer of heavy marine diesel engines. (ESB/22082/58.)

GREECE, October 14—Machine tools. (ESB/23335/58.)

Forthcoming Events

OCTOBER 4

Institute of British Foundrymen

Lancashire branch: "Controlled-slag Hot-blast Cupola," by D. Fleming, 3 p.m., at the Midland Hotel, Manchester.

OCTOBER 7

Institute of British Foundrymen

Beds. & Herts. section: Presidential evening, 7.30 p.m., at K. & L. Steelfounders and Engineers, Limited, Letchworth.

Incorporated Plant Engineers

London branch: "Free-piston Engine and its Application," by R. W. S. Mitchell, B.Sc., 7 p.m. (tea 6.30 p.m.), at the Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2.

OCTOBER 8

Incorporated Plant Engineers

East Midlands branch: "Field Work in Atmospheric Pollution," by D. G. Lucas, 7 p.m., in the Sherwood Room, County Hotel, Theatre Square, Nottingham.

OCTOBER 9

Institution of Production Engineers

Leicester section: "Development of High-speed Machining Techniques for Non-ferrous Materials," by S. Radcliffe, B.Sc.(Tech.), 7.15 p.m., at Wadkin, Limited, Green Lane Works, Leicester.

OCTOBER 11

Institute of British Foundrymen

West Riding of Yorkshire branch: "Surface Finish of Castings," by Dr. D. V. Atterton, 6.30 p.m., at the Bradford Institute of Technology.

PRODUCTION HAS BEEN TEMPORARILY SUSPENDED at the foundry of Auto-Malleable (Bingley), Limited, malleable ironfounders, Phoenix Works, Crossflatts, Bingley, for an estimated period of two months. The acting manager Mr. F. Lowe, said that the foundry is being changed from jobbing work to mass production, but it is hoped to re-engage some of the 45 employees after the two-month period.

Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

October 1, 1958

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2: Middlesbrough, £21 6s. 0d.; Birmingham, £20 18s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £23 17s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £24 1s. 3d.

Scotch Iron.—No. 3 foundry, £25 3s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 19s. 0d.; South Zone, £26 1s. 6d.

Refined Malleable.—P, 0.10 per cent. max.: North Zone, £27 6s. 6d.; South Zone, £27 9s. 0d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent.: N.-E. of England (local iron), £25 6s. 6d.; Scotland (Scotch iron), Zone S.1, £25 13s. 0d.; Sheffield, £26 15s. 0d.; Birmingham, £27 4s. 0d.; Wales (Welsh iron), £25 6s. 6d.

Basic Pig-iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leics.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si, £44 0s. 0d. to £44 10s. 0d., scale 15s. 0d. per unit; 75 per cent. Si, £62 0s. 0d. to £62 10s. 0d., scale 17s. 0d. per unit.

Ferro-vanadium.—50/60 per cent., 22s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 6d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 6s. 6d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 9s. 6d. per b. of W.

Ferro-chrome (6-ton lots and over).—4/6 per cent. C, £83 10s. 0d. to £87 0s. 0d., basis 60 per cent. Cr, scale 30s. 0d. to 30s. 6d., per unit; over 6 per cent. C, £79 10s. 0d. to £85 0s. 0d., basis 60 per cent. Cr, scale 30s. 6d. per unit; 2 per cent. C,* 2s. 0d. per lb. Cr; 1 per cent. C,* 2s. 0½d. per lb. Cr; 0.15 per cent. C,* 2s. 1½d. per lb. Cr; 0.10 per cent. C,* 2s. 1¾d. per lb. Cr; 0.06 per cent. C,* 2s. 2d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £265 0s. 0d.; 96/98 per cent., £295 0s. 0d.

Ferro-columbium.—65/72 per cent., Nb + Ta, 19s. 9d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £78 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., £32 15s. 6d.; tested, 0.08 to 0.33 per cent. C, £33 15s. 6d.; hard (0.41 to 0.60 per cent. C), £34 17s. 0d.; silico-manganese, £43 16s. 6d.; free-cutting, £36 14s. 6d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £41 1s. 0d.; silico-manganese, £44 4s. 0d.

* Average 68-70 per cent.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.33 per cent. C, £38 10s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £39 12s. 6d.; acid, up to 0.25 per cent. C, £43 4s. 0d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £42 2s. 0d.; boiler plates (N.-E. Coast), £44 12s. 0d.; floor plates (N.-E. Coast), £43 11s. 0d.; angles (N.-E. Coast), £39 16s. 6d.; joists (N.-E. Coast), £39 12s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £40 0s. 6d.; under 10 tons to 4 tons, £40 18s. 0d.; under 4 tons to 2 tons, £41 3s. 0d.; hoop and strip, coils, £39 0s. 0d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g., £44 16s. 0d.; black sheets (hand mill), 24g., £58 14s. 6d.; galvanized corrugated sheets, 24g., £66 16s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £68 10s. 0d.; nickel-chrome, £99 11s. 0d.; nickel-chrome-molybdenum, £111 19s. 0d.

NON-FERROUS METALS

Copper.—Cash, £213 0s. 0d. to £213 5s. 0d.; three months, £213 0s. 0d. to £213 5s. 0d.; settlement, £213 5s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 0½d. per lb.; rods, 228s. 6d. per cwt. basis; 20 s.w.g., 263s. 6d. per cwt.

Tin.—Cash, £728 0s. 0d. to £730 0s. 0d.; three months, £718 0s. 0d. to £719 0s. 0d.; settlement, £730 0s. 0d.

Lead (Refined Pig).—First half October, £71 0s. 0d. to £71 5s. 0d.; first half January, £72 5s. 0d. to £72 10s. 0d.

Zinc.—First half October, £66 0s 0d. to £66 5s. 0d.; first half January, £66 10s. 0d. to £66 12s. 6d.

Zinc Sheets, etc.—Sheets, 15g. and thicker, all English destinations, £99 5s. 0d.; rolled zinc (boiler plates), all English destinations, £97 0s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £87 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 7⅞d. per lb.; sheets to 10 w.g., 177s. 6d. per cwt.; wire, 2s. 5⅜d.; rolled metal, 177s. 6d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £141; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £170; HTB2 (38 tons), —; HTB5 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £174; LG3 (86/7/5/2), £184; G1 (88/10/2/½), £241; (88/10/2/1), £233.

Phosphor Bronze.—BS1400, PB1 (AID released), £259 per ton.

Leaded Phosphor Bronze.—BS1400, LPB1 (1060), £193 per ton.

Phosphor Bronze Strip, etc.—Strip, 260s. 3d. per cwt.; wire, 3s. 9¾d. per lb.; rods, 3s. 1¼d.; tubes, 3s. 1½d.; chill cast bars: solids 3s. 0½d.; cored 3s. 1½d. (CHARLES CLIFFORD, LIMITED.)

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 7d. per lb.; round wire, 10g. in coils (10 per cent.), 3s. 11¾d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 3s. 10¾d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £190 0s. 0d. Quicksilver, ex-warehouse, £79 0s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £180 0s. 0d.; aluminium bronze (BS1400), AB1, —; AB2, —.